SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 21. [NEW SERIES.] NEW YORK, MAY 22, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]

Artificial Respiration.

The *Medical Press and Circular*, 1880, informs us that in a recent communication to the French Academy, Professor Fort raises again the question of premature interments. One fact he mentions is, that he was enabled to restore to life a child three years old, by practicing artificial respiration on it four hours, commencing three hours and a half after apparent death. Another case was communicated to him by Dr. Fournol, of Billancourt, who, in July, 1878, reanimated a nearly drowned person after four hours of artificial respiration. This person had been in the water ten minutes, and the doctor arrived one hour after asphyxia. Professor Fort insists also on the utility of artificial respiration in cases of poisoning, in order to eliminate the poisons from the lungs and glands. The length of time it is desirable to practice artificial respiration in any case of apparent death from asphyxia, Professor Fort has not yet determined, but his general conclusion is that it should be maintained perseveringly for several hours.

The Efficiency of the Water Trap.

A contemporary publishes an important experimental investigation by Dr. Neil Carmichael concerning the trap and water closet system, and their relation to sewage products, gaseous and others. As the result of this investigation, Dr. Carmichael came to the conclusion that an efficient water trap excludes soil pipe atmosphere to such an extent that what escapes through the water is so little in amount, and so purified by filtration, as to be perfectly harmless. The water trap, he further concludes, stops entirely the passage of all germs and particles from the air of the soil pipe, including the specific germs or contagia of disease, which, so far as is known, are particulate. He thus traverses entirely the belief so largely entertained that the water of a trap, however perfect in arrangement, will absorb the air of the soil pipe until saturated, and then give it off harmfully on the house side. He would rehabilitate the old faith in the sufficiency of the water to insure safety, and he would refer the harm from traps to their imperfect sealing, or to various deteriorations in the structure of the water closet or soil pipe which permit direct communication between the air of a house and the air of the soil pipe. The series of experiments on which Dr. Carmichael has founded these conclusions are exceedingly ingenious, and would certainly appear to justify them, but we doubt whether he has been sufficiently careful in indicating the conditions under which the safety of the water trap can be secured.—*Lancet.*

THE BABCOCK & WILCOX WATER TUBE BOILER.

Efficiency, economy in the use of fuel, and safety are qualities which are absolutely requisite in a boiler in these days of the wide application of steam, and notwithstanding the care taken in the construction and use of shell boilers for either high or low pressure, neither the user nor the people in the vicinity of them can feel any degree of safety.

The boiler shown in our illustrations is not only one of the most economical and efficient, but it is absolutely safe from destructive explosion at any pressure, and possesses, in addition, the quality of lightness and portability of parts, a very important feature when the matter of transportation is considered.

Our front page illustration represents a nest of four boilers of the Babcock & Wilcox type. These boilers were recently constructed, and are now in successful operation at the Standard Oil Company's Refinery, Greenpoint, L. I. The side elevation gives an excellent idea of the construction of the boiler and furnace, and the relative arrangement of the various parts.

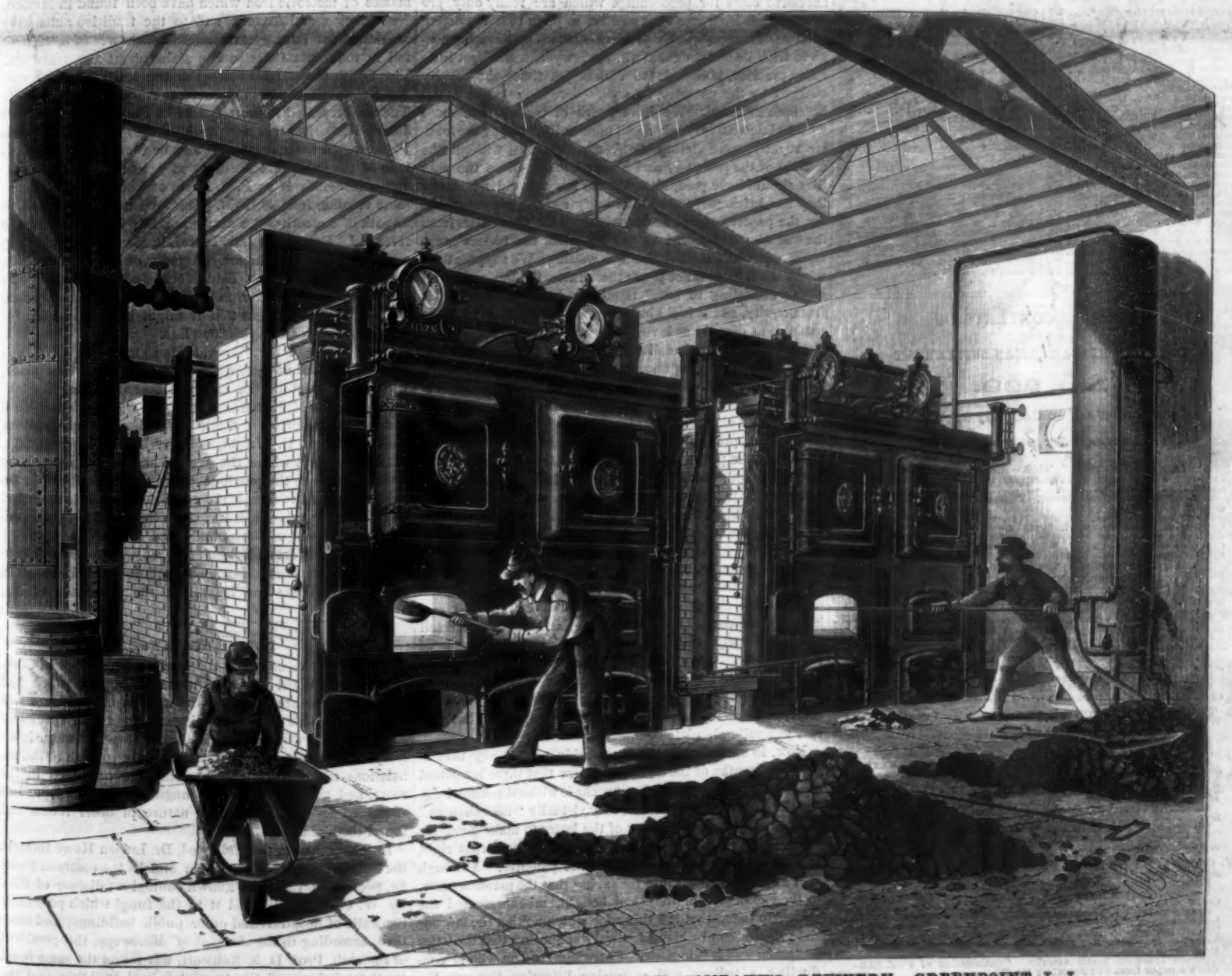
It will be seen that the construction of the boiler is radically different from the ordinary flue boiler, in which the water surrounds the tubes and flues, as in this boiler the order of things is reversed; the water circulates through the tubes and two drums, the exterior surface of which affords a very large and effective heating surface.

This boiler is composed of lap-welded wrought iron tubes, placed in an inclined position, and connected with each other, and with a horizontal steam and water drum, by vertical passages at each end, while a mud drum connects the tubes at the rear and lowest point in the boiler.

The end connections are in one piece for each vertical row of tubes, and are of such form that the tubes are "staggered" (or so placed that each horizontal row comes over the spaces in the previous row). The holes are accurately sized, and the tubes fixed therein by an expander. These are connected with the water drum, and the mud drum also, by short tubes expanded into bored holes, doing away with all bolts, and leaving a clear passage way between the several parts. The openings for cleaning opposite the end of each tube are closed by hand-hole plates, the joints of which are made in the most thorough manner by milling the surfaces to accurate metallic contact. They are tested and made tight, under a hydrostatic pressure of 500 pounds per square inch, iron to iron, and without packing, rubber, or other perishable substance.

The fire is made under the front or higher end of the tubes.

[*Continued on page 325.*]



BABCOCK & WILCOX BOILERS AT THE STANDARD OIL COMPANY'S REFINERY GREENPOINT, L. I.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included..... $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address
MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

Is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, MAY 22, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 229,

For the Week ending May 22, 1880.

Price 10 cents. For sale by all newsdealers.

PATENT LAW AND EQUITY

We lately referred to suggested amendments to the patent law at the Senate hearing in relation to bill No 4412, which passed the House several weeks ago, and the text of which we gave in our issue of March 6. The amendments suggested by members of the committee themselves during the hearing, plainly indicate that this particular bill will never be approved by the Senate in its present form, yet we do not know but, outrageous as it was, its introduction, and even its passage through the House, has been productive of some good, for it has opened the eyes of those interested in patents to the necessity of constant watchfulness, if, in the present state of the public mind, they would protect their property, and the discussion it has provoked has assisted to spread among the community a better knowledge of the principles of patent law. But taking it for granted that here, as Mr. Playfair says is the case in England, there is now "a general *concensus* of public opinion, that it would be dangerous to national interests to abolish patents for inventions," as bill No. 4412 would practically have done in many cases, there can be no doubt but that *some* change in our present law, or in the equalized methods of practice thereunder, is now generally called for.

Perhaps the principal fault found with the law as it now stands arises from the fact that, in so many cases, people buying what is openly sold are afterward compelled to pay again to other parties for what they had already bought, or supposed they had bought of those who had a right to sell. This is where the opposition to the present law has heretofore derived its principal strength in the popular mind, and without this support, from those who honestly think they have been aggrieved, all the efforts of interested parties in opposition to the rights of patentees would be of little avail.

Next to this complaint, probably, would come that of taxation for patents on things long in common use, where the patentee could make out a case of infringement only by a great stretch of his claim, but would expect parties to pay a small tax rather than "go to law" about it. This class of cases are best met by the clubbing together of the defendants to share the expense of a defense, a course which has frequently been adopted in the Eastern and Middle States, and which affords, under the law, a ready means of obtaining justice at but moderate cost to each one of the defendants. Much less is now said against the patent law on this score than was formerly urged, so feasible and practical has this mode of defense proved.

Added to the above causes of complaint, and as a later issue, there has been developed an increasing tendency among a certain proportion of the legal fraternity to charge excessive costs for proceedings which are really only *pro forma*; that is, where the cases are so plain that the defendant would not, with any proper notification, allow them to go to trial, or be brought at all, the lawyers have, by a little sharp practice, been able to collect ten times the royalty charged by the patentee, *as costs*, where no expense at all had been incurred. We have heard of cases where those who had unwittingly infringed, upon calling to pay the regular royalty, were victimized by the attorneys, without the consent of the patentee, and charged many times the sum they should have paid, although the lawyers did not know they had infringed, and did not know against whom to make out the papers, except as they obtained the particulars from the one who had called to pay up, when the papers were made out while their victim was waiting. We suppose that, where the latter cannot prove these facts, the business is all done "according to law," though it is certainly very far from equity, and it is a kind of practice which injures the patentee as directly as it robs the public.

As to those who are called upon to pay for a patent a second time, after having once bought a supposed right, there probably can be no law framed which would completely obviate the evil. The issuing of the patent gives the patentee a *prima facie* claim against any one using the patented article, device, process, invention, or discovery, without the consent of the patentee or his representative. Whether this claim is good, should the presumed infringer decline to recognize it, the United States courts must decide. Many cases of this kind, usually brought as equity trials, take from two to five years, and costs thousands of dollars, when perhaps the royalty charged by the patentee, or the damages which might be obtained from one infringer, would be trifling; but injunctions will not be issued by the courts against manufacturers or users until the case has been decided, and irresponsible parties may, meanwhile, manufacture and sell indiscriminately, with no practical remedy in the hands of the patentee. The latter may, and generally does, give notice through the papers that users of such-and such an article, device, or process, are infringing, but the manufacturer, or those interested in denying the validity of the patent, generally circulate counter statements.

Now, in all such cases, it is probably safe to say that at least nine-tenths of the infringers know that there is a patent on the article, and when they purchase without acknowledging the rights of the patentee, they virtually "take chances" on the question of the ability of the latter to make good his claim in the courts: if they lose, we do not see what right they have to complain, as against the patentee. Although they may have good cause for saying that the manufacturer, or the one of whom they had bought, misrepresented the matter to them, that is a thing for which neither the law nor the patentee can be blamed, always supposing that the latter has given due public notice of his claim, as one who is conducting a tedious and expensive litigation through the United States courts would unquestionably find it his interest to do. As the principal features of the law become generally better understood, we find that complaints on this score are steadily diminishing.

As to the last issue, touching excessive costs where there has been no expense, there was considerable discussion in the late Senate hearing, and here the point was particularly brought out that it was entirely unnecessary to injure the rights of the patentee in seeking a remedy—that, in fact, this was an extremely roundabout and impracticable way. It is only the mode of practice here which needs amendment, and Mr. Storrow, of Boston, with the evident approval of the committee, urged that a bill be framed which should provide that the defendant might come into court and confess judgment before suit, and then be excused from costs or have to pay only such as had been actually incurred to that time.

This is, of course, in cases where it is not sought to question the validity of a patent, and no claim is set up in the way of a genuine defense to make it to the interest of the lawyers of the patentee to have the costs as light as possible. Some such law as this would be likely to do away with much entirely unnecessary litigation, and we do not see why its provisions should not apply as well to all cases brought in the United States courts. It would be only carrying out the doctrine of the common law, and ought to be made so as to bring down the costs in patent cases, where no genuine defense was set up, so that they would not exceed the costs of suits for similar amounts in the local or State courts.

TWO METEORITES.

We are indebted to M. John Isaac, of the San Bernardino (Cal.) *Times*, for an excellent photograph of a large meteorite, found at Ivanpah, near that place, a few months ago. It is the second specimen hitherto found in California. It weighed 128 pounds, and is nearly pure iron. It is covered with curious cup-shaped cavities, which in more than one case may be called holes. On one end a natural face shows a network of well defined crystals. A slab has been cut from the large mass, and the polished surface acted on by dilute nitric acid, by which treatment Widmannstattian figures of remarkable beauty were developed. This is the only holosiderite found on the Pacific coast as far as known, which yields these curious markings.

A small mass of meteoric iron was found in California in 1871, and was described by Prof. Silliman in the *American Journal of Science and Arts* for July, 1873.

In a communication on the last found specimen, Mr. H. G. Hanks, of the State Geological Society, refers to the large masses of meteoric iron which have been found in Mexico, New Mexico, and Arizona, and to the tradition among the inhabitants of Tucson, Arizona, that a shower of meteorites fell in the Santa Caterina Mountains about 200 years ago. The Smithsonian Institution has the 1,400 pound Irwin-Anisa meteorite found near Tucson. Another specimen from Tucson, presented to the city of San Francisco, by General James H. Carleton, is now at the rooms of the California Pioneers. A description of it may be found in the proceedings of the California Academy of Science, vol. 3, folio 48, and a full analysis by Prof. Bush, of Yale College. In the same volume, folio 30, Prof. Whitney has shown that a belt or path of meteorites lies nearly in a line from the Colorado river at La Paz to San Luis Potosi, in Mexico, possibly fragments of the same meteor. A mass of metallic iron was found by Dr. Evans on Bald Mountain, near Port Orford, in Oregon. San Barnardino is in the same general direction, and Mr. Hanks suggests that it might be well to look for other fragments along the same line.

Photographs of the Westville (Ind.) meteorite have been kindly furnished us by Mr. W. C. Ransbury, of that place, with an account of the circumstances attending its fall, about the first of November, 1876. It was not found until the following spring. While preparing a corn field for plowing, Mr. G. D. Wright, of Westville, La Porte county, came to a place where the ground had been furrowed for several feet since the previous year's cultivation, and in the western end of the furrow the meteorite lay. It is described as a dark, irregular mass full of cavities and irregular projections. It weighs 324 pounds, and measures 25 by 24 by 16¼ inches. It has not been analyzed. It appears to contain iron (in great abundance), copper, and nickel, also silica and mica. The stone is still in the possession of Mr. Wright.

HOUSEHOLD FUNGI.

At a recent meeting of the Buffalo Microscopical Club, Mr. Jas. W. Ward exhibited a piece of glass which had been over a picture on one of the walls of his residence. It was covered with a very peculiar and interesting species of fungus, which withstood the action of soap and water in attempting to remove it. He attributed the growth to the exhalations of the breath of persons who had been in the room, and since noticing this fungus on the glass, he had examined several of a similar nature in other rooms and found them alike.

In the discussion that followed, Dr. Lucien Howe thought the fungus similar to that which attacks the common house fly, producing the well known contagious disease of flies. Dr. W. C. Barrett likened it to the fungi which permeates the walls of hospitals and other public buildings; and since then, according to the *Journal of Microscopy*, the president of the club, Prof. D. S. Kellicott, has found the same fungi on the windows of the Central School Building, and the

City and County Hall of Buffalo. Whether these fungi are associated with any human disease does not appear. If they will kill flies without harming humanity their multiplication is rather to be desired.

A NEW INDUSTRIAL SCHOOL OF ART IN NEW YORK.

The hopes expressed, at the recent dedication of the new building of the Metropolitan Museum, with regard to the future of the industrial art school in connection therewith, bid fair to be realized much sooner than was then anticipated. A liberal gentleman, whose name is withheld at his own request, has offered the trustees of the Museum the use of a piece of ground fronting 200 feet in First avenue, near Sixty-seventh street, and extending in the rear 130 feet, for three years free of rent. In addition, he proposed to erect upon it, at his own expense, a suitable building for such schools, with a frontage of 200 feet on the avenue and two wings running back to the end of the lot. Moreover, he agreed to support these schools for three years at his own expense—allowing them to be entirely under the supervision of the trustees of the Museum during this period. All this he proposed to do in order to demonstrate beyond peradventure the advantages and necessity of such schools. The trustees of the Museum naturally lost no time in accepting the generous proposition.

It is expected that the new building will be ready for the opening of the schools in the autumn of the present year. It will be of brick and stone, and will cost about $10,000. In these schools will be regular day classes, and if occasion seems to demand it, night classes. It is intended that there shall be classes in drawing and designing, not only as applied to woodwork and iron, but a painting department will be opened, in which will be taught the principles of mixing colors, their chemical composition, and the effects of light and temperature upon them, the laws of harmonies and contrasts. Another department will be devoted to technical instruction in woodwork, and probably others in the working of iron and stone.

Diplomas and prizes will be given to the most successful competitors, and every effort will be made to advance and strengthen American industrial art.

Earthquake Shocks Superficial.

The superficial character of a Nevada earthquake was noticed some months ago. The Eureka (Nevada) *Leader* of April 17, relates another and similar experience. A miner at work in a mine on Prospect Mountain during the last shake at Secret Cañon says that while the tremor was plainly felt by his partners on the surface, he, at a depth of eighty feet, noticed nothing unusual.

The same miner says that through an experience of fifteen years underground he has observed one peculiar phenomenon, namely, that loose stones and bits of earth in mines are sure to fall between twelve and two o'clock at night. About this time it seems that everything begins to stir, and immediately after twelve, although the mine has been as still as the tomb before, the fall of little particles of rock and earth will be heard, and if there is a caving piece of ground in the mine it is sure to give way.

It would be interesting to know if other miners have ever observed this phenomenon.

A Recent Nickel Plating Decision.

Judge Blatchford, of the United States Circuit Court, has just rendered an important decision in the case of the United Nickel Company against Pendleton, which was a test suit with regard to the nickel plating patent. The case was argued some two months ago on a motion to attach for contempt, and the decision was awaited with much interest by the entire nickel plating trade. Judge Blatchford finds, as a matter of fact, that Pendleton was not using the double acetate solution, and denied the motion for contempt. There is much rejoicing among the nickel platers, who were bound to pay a royalty averaging about two cents a gallon per day, according to the capacity of the tank used for the solution, and this regardless of the quantity consumed, or of the fact that it might be empty. As these tanks in some large establishments equal 2,000 gallons, the tax was regarded as peculiarly onerous. Even for a 100 gallon tank $2 a day or $12 a week was a payment sometimes complained of as a grievous hardship. Unfortunately for this class, the great body of manufacturers are committed for another year, having taken out their licenses dating from the 1st of April, the delay in rendering the decision thus working in favor of the plaintiffs to this extent.—*World.*

A Fat Boiler Explodes.

A fat boiler in a soap factory in Detroit exploded May 2, fortunately without killing any one. The boiler was a cylindrical shell of quarter inch iron, twelve feet high, five feet in diameter, and surmounted by a conical top, in which was a man-hole capped as is usual in steam boilers. The boiler contained between 6,000 and 7,000 pounds of tallow, boiling under a steam pressure of 35 pounds. The top of the boiler was thrown up through the second floor and roof of the building, over a corner of a three story building, and fell about a hundred feet from where it started. A shower of grease covered an area from 100 to 300 feet wide and about 400 feet long. The boiler had been used six years, and had been corroded within by the fatty acids until it was no thicker than a silver five cent piece. A considerable portion of the factory was wrecked, but only one man was hurt, and he but slightly.

THE NATIONAL ACADEMY OF SCIENCE.

GLEANINGS FROM PAPERS READ.

Mention was made last week of the more important proceedings of the meeting of the National Academy of Science, April 20–23. In his paper on the sea urchins of the Challenger Expedition, Prof. Agassiz said that the new species taken belonged to a fauna not known along our shores, but limited to the slope of the continental plateau, at depths ranging from 100 to 2,000 fathoms, and called by him the Continental and Oceanic Districts. From these districts the Challenger had collected forty-nine new species, and the Coast Survey and other expeditions about thirty-five. These were all in addition to the two hundred species known in 1874. Only two new shore species were found by the Challenger. The most interesting of recent discoveries in the sea urchin line are of two new families of this group, which represent more or less ancient fossil types of Palæozoic and Cretaceous times, types previously supposed not to exist in recent seas.

The marine districts into which the sea bottom is divided in indicating the bathymetrical limits of sea urchins were given as follows: The littoral, down to 100 or 150 fathoms; the continental, from 50 to 600 fathoms; and the oceanic, from 500 to 2,900. The continental sea urchins date back to the Tertiary, and the oceanic to the time of the chalk, of which they are very characteristic. All of the species collected by the Challenger had previously been collected by the Coast Survey in 1867 and later years.

Professor Packard's study of the internal structure of the brain of king crabs (*Limulus*), commonly known as horse-foot crabs, led him to divide the histological elements into three kinds: 1. Large ganglion cells, filled densely with granules, and with a well defined nucleus similarly filled, and with a granular nucleolus. These cells terminate in large fibers, which subdivide. 2. Nerve fibers; these, like the large-sized ganglion cells from which they originate, are stained tawny brown with osmic acid. These fibers are coarse, their granular contents homogeneous. 3. Numerous very small nerve fibers, arising from very small nucleated cells. 4. Rounded masses inclosed in a network of fibers. In staining they resemble the *marksubstanz* of Diehl and the *punctsubstanz* of Leydig, but here the resemblance ends, as these balls are apparently composed of very minute nucleated cells and fine fibers arising from them. The general topography of the brain of *Limulus* is on a simple plan compared with that of *Decapodous crustacea* and insects. The brain is mostly composed of large irregular rounded masses or balls of granules, with a thick fungoid or ruffle-like periphery, formed by a layer of secondary smaller, rounded, granular masses. The lower half of, or two-thirds of, the entire brain is filled with these fungoid masses. In the upper third of the brain, whence the nerves originate, the larger ganglionic cells and the nerve fibers appear and preserve a definite topographical relation to the entire brain. The asymmetry of the brain is remarkable. Histologically, judging by his specimens of the brain of the lobster, the brain of *Limulus* agrees with that of other arthropods in having similar large ganglion cells. The smaller ganglion cells, so abundant in the brains of insects and crustacea, are wanting in *Limulus*. There are in *Limulus* no *ballen substans* masses homologous with those of the other arthropods. Topographically the internal structure of the brain of *Limulus* is constructed on a wholly different type from that of any other arthropodous type known; so much so that it seems useless to attempt to homologize the different regions in the two types of brain. The plan is simple in *Limulus;* much more complicated in arthropods, especially in the brain of the crayfish, as from the decapodous brain there arises two pairs of anternal nerves besides the optic pair, and in external form the two types of brain are entirely unlike.

In his communication on the brains of extinct animals, Prof. Marsh reaffirmed his discoveries touching the law of brain growth, viz.: 1. All tertiary mammals had small brains. 2. There was a gradual increase in the size of the brain during this period. 3. This increase was mainly confined to the cerebral hemispheres, or higher portion of the brain. 4. In some groups the convolutions of the brain have gradually become more complicated. 5. In some the cerebellum and olfactory lobes have even diminished in size. 6. There is some evidence that the same general law of brain growth holds good for birds and reptiles from the cretaceous to the present time.

A series of observations on the *Odontonorthes*, or birds with teeth, from the cretaceous was first presented, and the skull and brain of the extinct *Hesperornis* were compared with those of the Loon (*Colymbus*), and the former was found to have a brain of less than one-third the size of the latter, and much more reptilian in form and proportion. The brain in two *Dinosaurians* (*Morosaurus* and *Stegosaurus*) was next compared with that of the crocodile. *Stegosaurus* was found to have a brain very much smaller than the crocodile, and other Dinosaurs agreed essentially in the same feature. It was also shown that of ancient animals those with small brains and large bodies were especially those that became extinct, those with large brains being more likely to survive.

In his paper on the Taconic system in geology, discovered by Eaton and maintained by Emmons, Prof. T. Sterry Hunt reviewed the evidence of a great and widespread series of rocks, pre-Cambrian in age, and occupying the position assigned by Emmons to the Lower Taconic or Taconian system, which, according to him, extends continuously along the Appalachian Valley from Vermont to Alabama, and more or less occupies large areas to the southwest of the Blue Ridge, from Virginia to Georgia, constituting in South Carolina the Itacolumite series of Lieber. Within the vast area occupied by these rocks in the great valley have been found a few small areas of fossiliferous strata, belonging chiefly to the Ordorian or Lower Cambrian series, but the characters of the great mass of these rocks are such as to lead to the conclusion that they constitute, as maintained by Emmons, a more ancient series. To the Lower Taconian rocks belong the peculiar magnetic iron ores found at Reading, Cornwall, and Dillsburg, Penn., which have been by some geologists regarded as Mesozoic, but were by Rogers assigned to the base of the Palæozoic. To this same series belong the limestones of the great valley, which occur in clays derived from the subaerial decay of the rocks. These, in their unchanged condition, contain beds and masses both of siderite and pyrites, and the alteration of these *in situ* has given rise to the limonites. In the formation of this from the siderite, or iron carbonate, it was pointed out by the speaker that there is a contraction of volume equal to about 20 per cent, to which is due the cellular character of the limonites and the frequent occurrence in them of Geodes. These older rocks are not without traces of organic life, having yielded in the Appalachian Valley the original *Scolithes* and related markings, besides obscure *Brachiopods;* and in Ontario, besides similar Scolithes-like markings, a form apparently identical with the more ancient gneisses. We may hope to find in the Taconian series a fauna which shall help to fill the wide interval that now divides the Eozoic rocks from the Lower Cambrian.

Describing the experiments lately made at the Allegheny Observatory in the measurement of radiant heat, Prof. Langley told of an improved thermo-electric apparatus due a product of the American iron industry. The experiments on a great variety of substances had thus far shown that iron in extreme thinness (cut into strips about one-third of a millimeter wide and 1-500 of a millimeter thick) was the best. The speaker exhibited specimens of iron rolled in the Pittsburg mills, which were so surprisingly thin that from 10,000 to 12,000 sheets laid on each other equaled only one inch in thickness. From these was produced an instrument which had almost the promptness of action toward radiant heat which the eye has toward light, and which possessed a greater sensitiveness than any thermopile, and the speaker hoped it might prove useful to other workers in the same line of research as himself.

In discussing the absolute brightness of the solar corona, Prof. Harkness, of the United States Naval Observatory, said that as the sun's limb is approached the intensity of the coronal light increases with such enormous rapidity that its total illuminating power is mainly derived from regions within two or three minutes of the solar disk. Hence, if the intrinsic brightness of the corona is even approximately constant, the darkness during totality should be much greater in long eclipses than in short ones; and in a brief totality the streamers may possibly be obliterated by the intensity of the inner corona. Methods were explained and formulæ given by means of which the observations of Prof. Pickering on the total eclipse of 1870, and the observations of Prof. Langley on the eclipse of July, 1878, were utilized and rendered comparable, and the conclusions finally reached respecting the amount and distribution of light in the corona of July 29, 1878, were summarized as follows:

1. The total light of the corona was 0·072 that of a standard candle at one foot distance; or 3·8 times that of the full moon; or 0·0000069 that of the sun.

2. The photographs show that the coronal light varied inversely as the square of the distance from the sun's limb.

Church Towers.

The towers of Cologne Cathedral are now the highest in the world, the height they have attained being 5 feet higher than the tower of St. Nicholas's Church in Hamburg, which has hitherto been the highest edifice. Ultimately they will be 51 feet 10 inches higher. The *Cologne Gazette* gives the following as the heights of the chief high buildings in the world: Towers of Cologne Cathedral, 524 feet 11 inches from the pavement of the cloisters, or 515 feet 1 inch from the floor of the church; tower of St. Nicholas, at Hamburg, 473 feet 1 inch; cupola of St. Peter's, Rome, 469 feet 2 inches; cathedral spire at Strasburg, 465 feet 11 inches; Pyramid of Cheops, 449 feet 5 inches; tower of St. Stephen's, Vienna, 443 feet 10 inches; tower of St. Martin's, Landshut, 434 feet 8 inches; cathedral spire at Freiburg, 410 feet 1 inch; cathedral of Antwerp, 404 feet 10 inches; cathedral of Florence, 390 feet 5 inches; St. Paul's, London, 365 feet 1 inch; ridge tiles of Cologne Cathedral, 360 feet 3 inches; cathedral tower at Magdeburg, 339 feet 11 inches; tower of the new Votive Church at Vienna, 314 feet 11 inches; tower of the Rath-haus at Berlin, 288 feet 8 inches; towers of Notre Dame, at Paris, 232 feet 11 inches.

An Invention Wanted.

A correspondent, writing from Colorado, says there is much need in those parts of a portable steam drill for prospecting purposes. It should be so constructed that it could be packed on a mule or carried in parts by two men. Its weight should not exceed 150 pounds, and it should not cost over $200. The machine should be capable of drilling granite to a depth of 50 feet, making a bore three-eighths to three-fourths inch in diameter. Our correspondent is confident that a large market would be found for such a drill in Colorado for gold and silver prospecting.

NOVEL SWIMMING DEVICE.

Our engraving represents a simple apparatus for the use of bathers and persons unable to swim, the invention of Mr. A. Gamonet, of Lyons, France.

Inflated India-rubber bags support the swimmer, and enable him to sit upright with head and shoulders above water, so that he can propel himself. The principal novelty of this contrivance lies in the propelling device, which is constructed so as to collapse when pulled forward, and to spread open when pushed back, like a duck's foot when swimming. The propellers are suspended by chains or cords attached to the buoying jacket.

NEW INVENTIONS.

Mr. William C. Beattie, of Taunton, Mass., has patented improvements in jewel cases and analogous articles; it consists in a stand or case, having a stationary bottom portion, a stationary and elevated top or cover, and two standards connecting the said top and bottom portion and forming a handle, in combination with one or more receptacles hinged upon the standards and folding horizontally between the stationary top and bottom portions.

A new key ring, which can be easily opened and may be locked securely, has been patented by Mr. Bryant H. Melendy, of Battle Creek, Mich. The invention consists of a flat ring a part of which is straight and provided with a cut, thus forming two ends and permitting the ring to be bent sidewise for admitting the keys. One of the ends of the ring is provided with a small shoulder, and a clasp is pivoted to the other end, which clasp swings over the end with the shoulder and locks it.

Mr. William E. Ferguson, of New York city, has patented an improved device for preventing the shifting of grain cargoes in vessels, and to strengthen the vessel at its weakest point, or at the point exposed to the greatest strain when the vessel is loaded to the dead-weight capacity with a cargo of grain.

Mr. William C. Beattie, of Taunton, Mass., has patented an improvement in pickle casters, butter dishes, jewel cases, sugar dishes, and other analogous covered dishes, which is designed to raise the cover of the article and maintain it in an elevated position.

An improvement in automatic car couplings has been patented by Mr. Orlo H. Drinkwater, of Cedar Point, Kan. It consists in a peculiar construction and arrangement of parts which cannot be clearly described without engravings.

A water and wind mill, which the inventor designates as a "wing-motor," of especial simplicity of construction, automatic in the adjustment of its sails, and capable of utilizing a large percentage of the power of the wind and current of water, has been patented by Mr. Jean L. Nevers, of Pass Christian, Miss.

Mr. Robert F. Dobson, of Darlington, Wis., has patented improvements in that class of weighing scales in which the weight of the object to be weighed is made to deflect a lever over a curved scale bar, and throw a weight carried by the lever into a position approaching more nearly the horizontal, in which the leverage of said weight is greater.

Messrs. Charles H. Spray and Edward M. Bush, of Seymour, Ind., have patented an improvement in the class of ovens of cooking stoves and ranges whose doors have a movable shelf so connected therewith that the opening and closing of the doors will slide the shelf along the bottom of the oven. The improvement relates to a shelf or false bottom, which is made the full size of the true bottom of the oven chamber, and is supported in guides and moved out and in, as the door opens and closes, by means of a rack and a segmental toothed lever that is connected with and operated by the door.

NOVEL SWIMMING DEVICE.

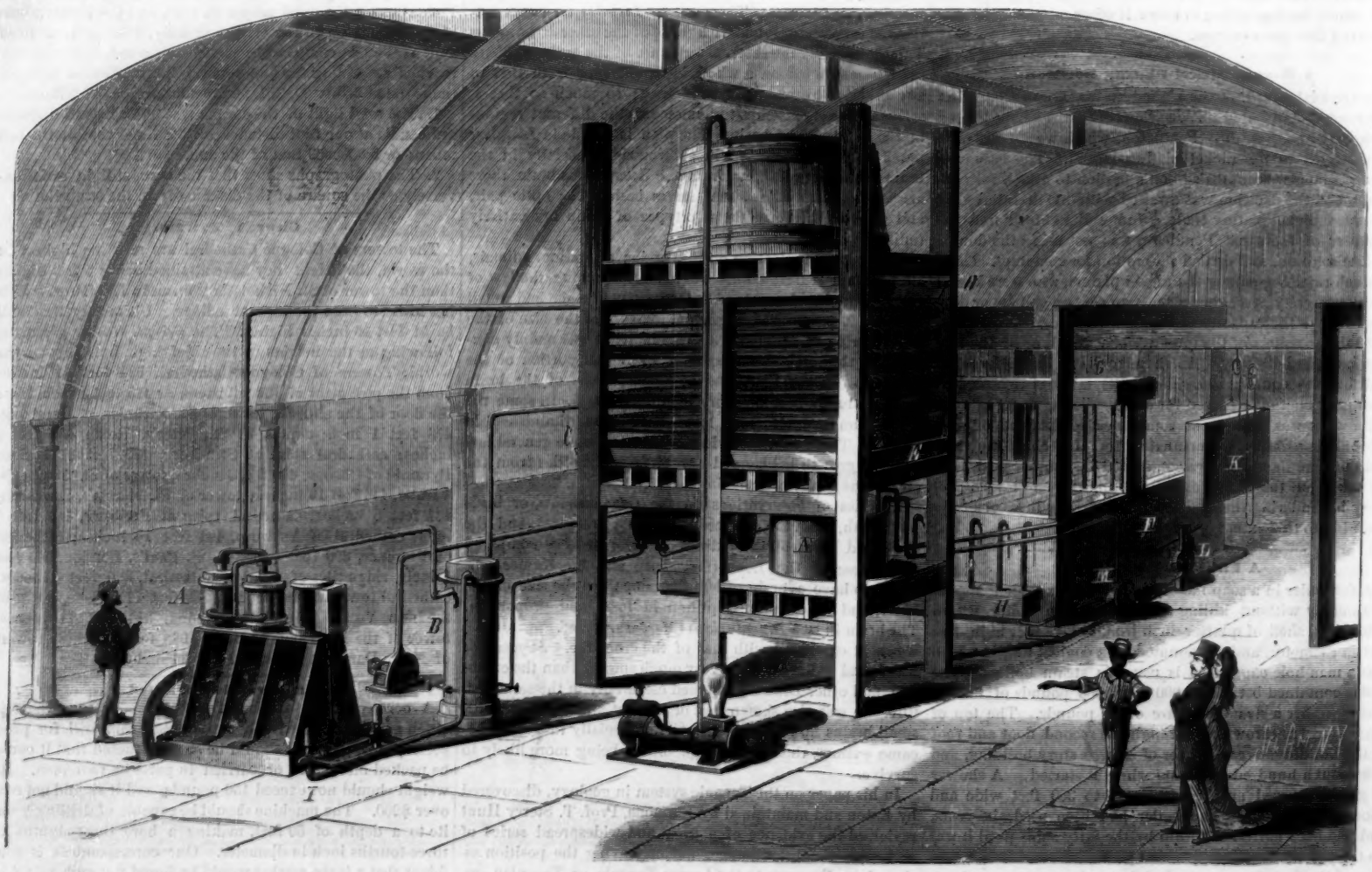
A LARGE ICE MACHINE.

The successful refrigerating apparatus of Messrs. D. L. Holden & Bros., 725 Sansom street, Philadelphia, as first developed for use in breweries, was quite fully described and illustrated in the SCIENTIFIC AMERICAN for August 18, 1877. Subsequent improvements and additions, fitting the apparatus for the manufacture of ice, were shown in our issue of March 16, 1878; and to-day we illustrate a section of what will probably be the largest ice factory in the world, the same system being employed. The factory is now approaching completion for the Compania Habanero de Hielo, of which Guillerino de Zaldo is president, at Havana, Cuba.

As in all machines of this class, refrigeration is produced by the conversion of a volatile liquid into vapor by the action of the exhaust pump; the vapor being recondensed by passing through coils immersed in running water, aided if necessary by the power of compression exerted by force pumps; thus pursuing an endless round of vaporization and recondensation. When this liquid is volatilized in the refrigerator, intense cold is produced and utilized by chilling a non-congealing liquid, which in turn serves to reduce the temperature of the air to be cooled, or, in the case of ice machines, the water to be frozen.

With this brief explanation of the general process the special working of the great machine figured in the accompanying illustration will be easily understood.

In the left foreground will be seen the vapor pumps, A, and the steam engine, resting on the same bed plate. Next in rear stands the upright refrigerator, B, with a pressure blower to the left. The volatile fluid used is chymogene. Behind the refrigerator, supported by a timber staging and surmounted by a large tank, are the condensers, C; the large upper coil condenser being of wrought iron, and the lower a cylindrical shell containing U tubes, through which the vapor to be liquefied passes. In the middle foreground stands the pump, which controls the fresh water supply, raising it to the tank above, whence it passes around the condensers, thence to the spray pan, D, whence it trickles to the lower pan, E, from which it is led away as waste or to the steam boiler as feed water. Back of the condensers is the ice box, divided into two compartments, containing twenty-eight congealers, through which the cold brine from the distributing system of pipes above the ice box is circulated. The overflow from the congealers falls into the double trough, H, whence the brine is led to the circulating pumps, I, which return it to the refrigerator. The fresh water to be frozen surrounds the congealers, and when converted into ice the congealers are loosened by a circulation of warmer brine. The ice is then hoisted out and conveyed to the point of delivery, K, by means of trucks running upon the rail track above. The pump, L, for the circulation of the fresh water in the ice box, to prevent the imprisonment of air-bubbles in the ice. The rotary pump, M, is used to circulate the brine to be warmed through a coil of pipe immersed in the tank of fresh water, N, which water is to be run into the ice box to be frozen. By this arrangement there is no loss of cooling effect when the brine is warmed for thawing out the converters. This machine is guaranteed to make ten tons of ice a day in Havana. Under more favorable conditions of temperature its capacity is rated at twenty tons of ice in twenty-four hours.

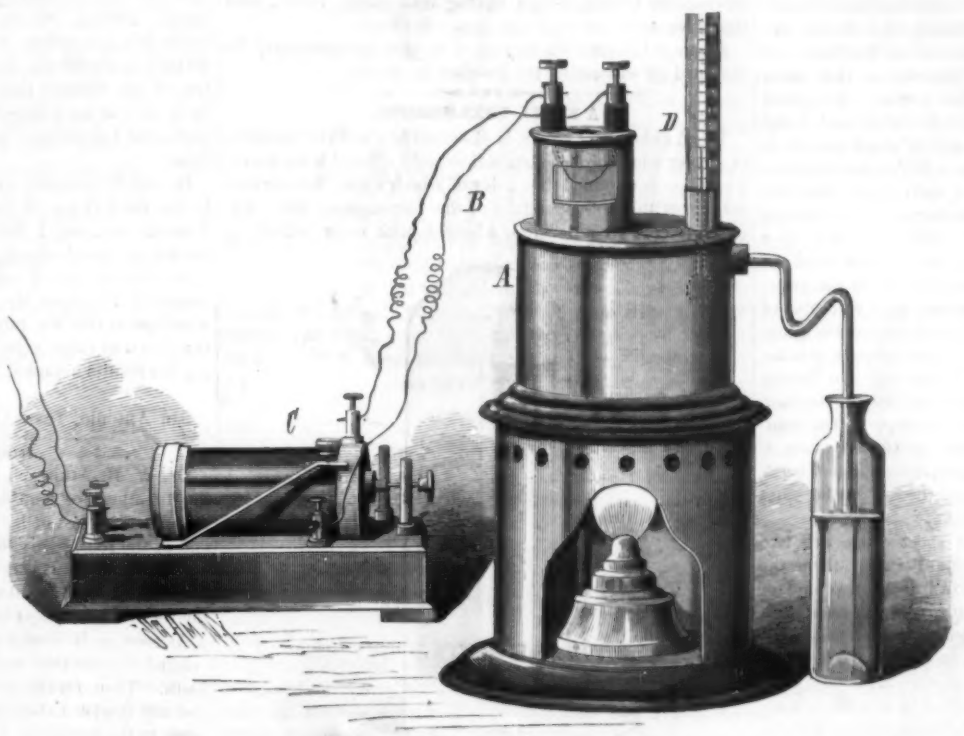


THE HOLDEN ICE MACHINE.

NEW OIL-TESTING APPARATUS.

The annexed engraving represents a new oil-testing device, recently patented by Mr. F. S. Pease, of Buffalo, N. Y., and designed for testing petroleum oils by electricity. A water bath, A, supported by a heating chamber, contains a cup for receiving oil, above which there is a dome, B, provided with two insulated binding posts, from which two or more electrodes project downward. These electrodes are provided with switches, by which one, two, or three sparks can be given at different points, and twenty or more changes can be made. The binding posts at the top of the dome are connected with the terminals of the secondary wire of an induction coil, C. A thermometer, D, is inserted in the top of the device to indicate the temperature of the oil, and an overflow pipe leads from the side of the oil cup near the top, and has a slight bend or trap formed in it to prevent the escape of vapors driven from the oil, while it admits of the overflow of the oil in case of its expansion, and always keeps the oil at a uniform height. The induction coil furnishes a constant means of igniting the vapor driven off from the oil, without the admission of air.

The ordinary closed and open test now in general use cannot be called absolutely correct, owing to the variations in expansion, the uncertainty in the application of the fire to the oil, there being no standard established as to the amount of fire to be applied or the point at which the vapor is to be ignited, the application of the point of light to the oil being optional with the operator. The new electrical test obviates all these difficulties, and secures tests which are always the same, and absolutely correct to a fraction of a degree. It determines the expansion of the oil, accounts for, corrects, and measures it; also prevents the escape of the hydrocarbon vapor, and regulates and keeps the oil at a fixed height and exact distance to the point of combustion, things never before accomplished. The electrodes are so arranged as to detect the vapor in its minimum quantity, and at any point relative to the surface of oil, and the igniting points being always at a determined distance from the oil. In testing refined oil the ordinary quantity used for the oil bath is about 3¼ fluid ounces, equal to 91·14 grammes; and properly refined, that is, an unmixed oil, when the distillation cut off at 52° Baumé, with a yield of, say 17 to 20 per cent, with a flash of 150° to 152° and fire test of 160° Fah., and market gravity of 45° to 46° Baumé, and real specific gravity of 800; such an oil, heated to its igniting point, expands four grammes, consequently the surface of the oil and vapor in the ordinary open or closed test approaches the fire at every degree of increase in the heat, and at its igniting point is 0·32 to 0·48 centimeter nearer than at the commencement of the test. No provision has ever before been made to compensate for this source of error.



PEASE'S OIL-TESTING APPARATUS.

In high test oils the amount of the hydrocarbon vapor is small, and is developed in detached quantities up to the point of combustion, and not of sufficient quantity to cover the oil test surface, and its tendency or attraction is to the moist sides of the oil bath; and when the test is usually made the vapor ignites at the side of the cup first, travels the entire circumference of the oil bath before flashing over the surface, while the center surface of the oil is comparatively free.

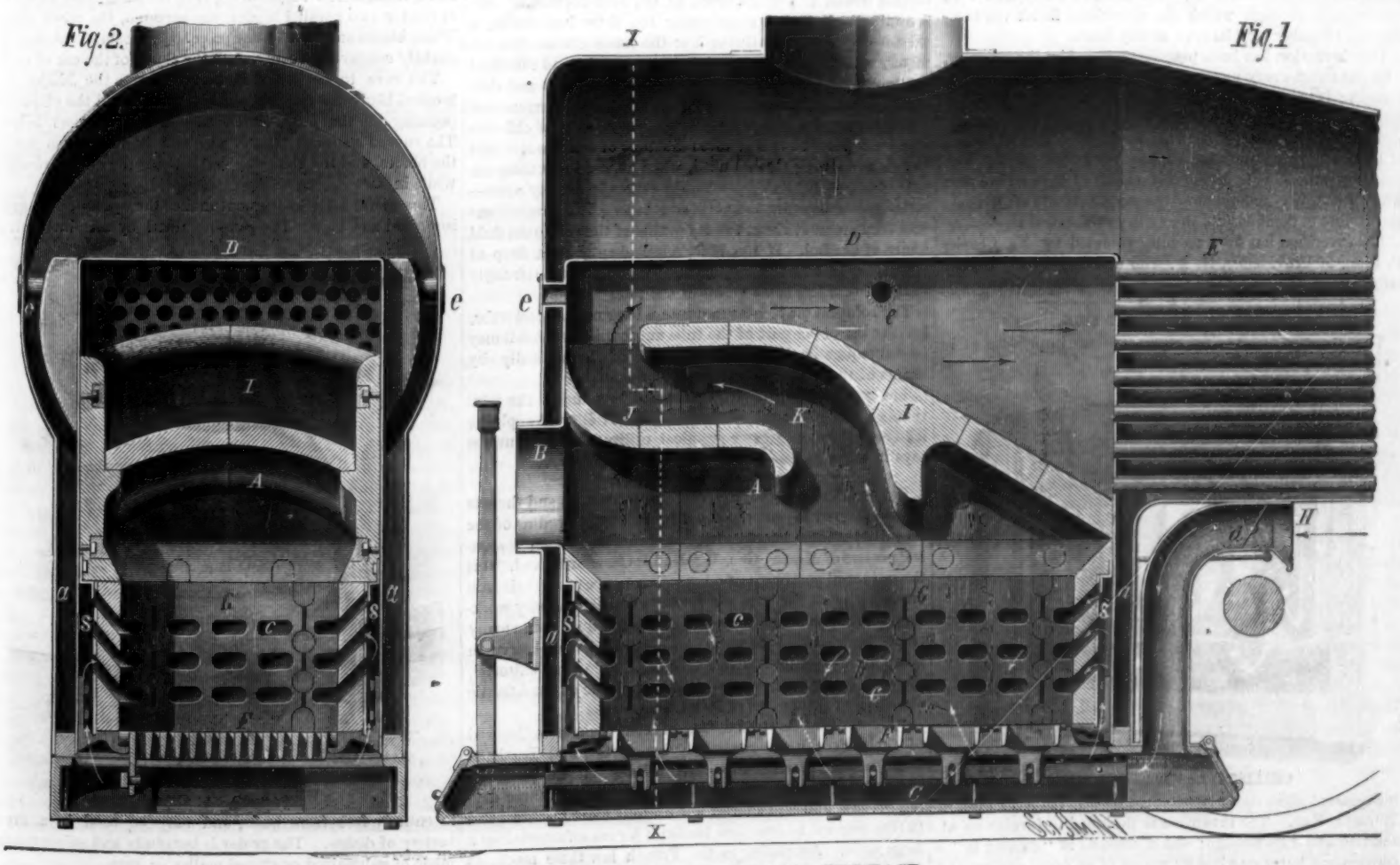
In low test oils the vapor is disengaged at every degree of increase in heat, making them more or less dangerous, and it only requires the half of one per cent of this vapor to make oils dangerous. Professor Chandler, of Columbia College, New York city, reports "that not one of seventy-eight samples selected at random throughout cities may be called safe."

Mr. Pease finds that refined petroleum oil is a good, if not a perfect, non-conductor of electricity; that by adjusting the two poles to a 0·32 of a centimeter apart, and placing them in the oil, a discharge from a powerful induction coil will not go through the oil, but will discharge between the two poles out of the oil, which are 1·92 of a centimeter apart. This fact enabled Mr. Pease to adjust and arrange a test to a minimum by arranging a pole in contact with the oil, with its point projecting upward toward a downwardly projecting point of the other pole, a moist surface of sufficient size being provided for the vapor. By this arrangement the vapor is detected, and explodes at the surface center of the oil bath as well as at other points, the spark being perpendicular to or from the oil. A horizontal discharge of sparks from the electrodes is a severe test, making a difference of one or more degrees for or against the oil. Mr. Pease's ingenuity has been displayed in a great many ways for the past 30 years, but it may be questioned whether his mechanical skill has ever better expressed itself than in the device referred to.

IMPROVED HOT-BLAST BOILER FURNACE.

In the minds of those conversant with the subject, no doubt exists as to the enormous waste going on in the majority of boiler furnaces in use to-day, and it is demonstrable that in many instances the better and even the greater part of the fuel goes out of the smoke stack unconsumed, and therefore unutilized. This is especially the case in the class of boilers used on locomotives and steamships, everything being sacrificed to compactness. Certain fundamental principles are involved in the combustion of fuel which seem to have been overlooked by inventors generally, and if not overlooked, the remedy for the evil results attending the non-observance of these principles seems to have been wanting. It is well known that boiler furnaces, as ordinarily arranged, are little else than gas retorts generating carbonic acid gas, carbonic oxide, and carbureted hydrogen: these gases under the conditions usually met in boiler furnaces are entirely wasted.

Carbonic acid is as incombustible as water, but if another portion of carbon be added or a portion of oxygen be withdrawn, carbonic oxide is formed, which, under the proper conditions, may be utilized and rendered a source of profit



PIKE'S HOT-BLAST BOILER FURNACE.

instead of loss, and, in some cases, even damage. These conditions are rarely or never met in ordinary boiler furnaces; they consist, first, in the introduction into the boiler furnace of a suitable amount of oxygen heated to insure its immediate admixture with the gases; and, second, in heating the mixed gases to the point of ignition before leaving the boiler furnace. These, all important requirements it is believed, are met in the boiler furnace shown in the accompanying illustrations. The distinctive features of this invention are the means by which air is heated and admitted to the fire box, and the means by which the combined gases are heated to the point of ignition before passing to the boiler.

Fig. 1 is a vertical longitudinal section of a locomotive fire box, showing the interior arrangement of fire walls and deflectors, and Fig. 2 is a vertical transverse section taken on line X X, in Fig. 1. In this boiler furnace, A is lined on all sides up to a certain height with firebrick, and is fed through the door, B, in the usual way. The ash pan, C, is provided with a blast pipe, H, having a flaring mouth opening toward the head of the locomotive, and capable of affording a more or less intense blast according as the locomotive is going fast or slow. The blast is also controlled by a valve, *d*, which may be operated by the fireman from the engine cab. The fire bricks, G, from the level of the grate, F, nearly up to the fire door and tubes, have a number of diagonal apertures, *c*, inclining downward toward the grate. These openings communicate with an air space, *s*, left between the bricks and the fire box, and opening into the ash pan below. By this arrangement the air entering the ash pan finds its way through the grates to support the combustion of the gases, and it also passes up the air space, *s*, and becomes highly heated by contact with the hot brick lining before it enters the fire box and the oxygen becomes mixed with the gases generated in the fire.

Between the fire bed and the crown sheet there are two peculiarly shaped arches, I, J, having between them the curved flue or throat, K, extending toward the rear end of the boiler. The main arch, I, extends from a point just below the tubes, upward and rearward, and is arched transversely and longitudinally, so that it cannot be displaced by any jarring or concussion that a locomotive is subject to in everyday use. The arch, J, is supported in a similar way, and both rest upon walls of refractory brick, the whole forming a complete self-sustaining arch.

In actual use the heated oxygen, and the gases generated from the burning fuel, are thoroughly mixed, and in their passage through the flue, K, between the highly heated arches, I J, becomes ignited, and is consumed before it can be sufficiently cooled to extinguish the flame. We are informed by eyewitnesses that the heat in this furnace, when in operation, is wonderfully intense, the entire interior of the furnace being in an incandescent state. The inventor states that a locomotive having this improvement applied, does not show a particle of smoke at the top of the stack, and that the useful effect of the coal is nearly doubled. As the blast is due to the advance of the locomotive, it follows that a free exhaust may be used, effecting a saving in fuel in another way. The peculiar manner of introducing the air to the ash pan has a great advantage besides that already referred to, that is: in case of snows, the draught is uninterrupted, as the air pipe is above the snow level. The fire box is supplied with windows, *e*, through which the operations inside the combustion chamber may be seen at any time.

This invention has been practically tested by the inventor, who has taken every measure to perfect his invention before bringing it to extended public notice. It has the indorsement of some of the most eminent engineers in this country, and promises to effect a great saving in operating all classes of boilers. This improvement deserves attention from railroad companies, as it is the invention of a practical man who thoroughly understands the requirements of the case and is able to demonstrate the utility of the device.

The invention has been recently patented by Mr. Charles F. Pike, of Providence, R. I., who will supply any further information desired by our readers.

NOVEL TRANSPARENT SIGN.

The annexed engraving represents an improvement in

CHILD'S TRANSPARENT SIGN.

transparent signs recently patented by Mr. Hubert Child, of Wichita, Kan. The invention is designed to furnish an attractive and durable sign; and it consists in "cutting in" a transparent letter on glass by means of an opaque color, and placing behind the glass another glass, and filling the interspace with broken glass, which may be either colorless or of different colors, so that when light shines through the transparent letter the plain character of the letter is broken up and diversified, producing very brilliant and striking effects.

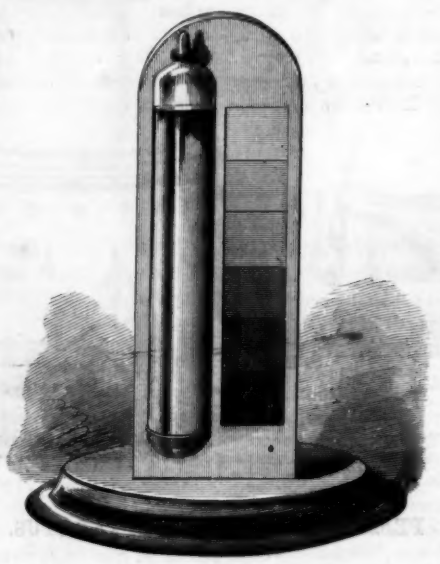
Frost and steam have no injurious effect on the sign. It will retain its character for an unlimited time, and will always look bright and fresh.

The inventor proposes to select different colors of glass and produce a brilliant panel, to be moved by suitable mechanism behind a sign having transparent letters, and thus give to the letters a kaleidoscopic effect.

Further information in regard to this invention may be obtained by addressing the inventor as above.

A NOVEL THERMOSCOPE.

When chloride of cobalt is dissolved in a definite quantity of strong wine spirit, or alcohol slightly diluted with water, a solution is obtained the color of which varies in a curious manner with the temperature of the surrounding air. Exposed to cold air it develops a bright pink color, which, as



COBALT THERMOSCOPE.

the temperature of the air increases, passes through various shades of color, until at last, when the liquid becomes quite warm, it assumes a strong blue or violet blue hue. These color changes are primarily due to the fact that in the cold alcoholic solution the salt appropriates a portion of the water, and when heated it parts with this water of crystallization or hydration. When the proportions of the chloride of cobalt, alcohol, and water are properly adjusted, and the liquid is sealed in a narrow glass tube, it becomes quite sensitive to change of temperature, and the varied changes of tint when compared with a standardized color scale may serve, within certain limits, as a rough index of the temperature of surrounding bodies, thus constituting the little instrument, a thermoscope, if not entitling it to the name chromothermometer, which has been given it. The statements to the effect that changes of color are due to the action of light and electricity or atmospheric humidity, etc., are of course erroneous.

To prepare the solution dissolve a few crystals of chloride of cobalt (pure) in two or three drachms of warm water, and to this add strong alcohol until, when exposed to a temperature of about 70° Fah., the liquid presents a slaty color—intermediate between the pink and blue. The proportions will then stand at about twenty grains of the salt to the fluid ounce of alcohol. If too blue, more alcohol or a drop of water may be added to the solution; if it inclines too strongly to the pink a few more grains of the salt.

The solution may be poured into a long narrow test tube, leaving the upper part of the tube unoccupied, so that it may be subsequently drawn out, and sealed hermetically by means of the blowpipe.

The remarkable properties possessed by some of the solutions of this salt certainly suggest the possibility of applying it to something of greater practical utility than the curious toys in which it has thus far been chiefly employed.

In the interest of every advance in mechanics and the arts we are pleased to note the favor in which the product of the recently invented board-cutting machine and steam seasoning presses of Messrs. Geo. W. Read & Co. are received. It is the universal sentiment of all who have once used their thin cut lumber that for strength, beauty of finish, and easy working, without shrinkage or warp, it is fully equal and in many respects superior to the sawed and planed. We observe in a late number of the *Cabinetmaker* the following editorial, showing that manufacturers on the other side of the Atlantic are availing themselves of its advantages:

"Messrs. Geo. A. Read & Co., of New York, have disposed of their French patents on drying presses and Bartlett's board cutting machine to a party in Paris, and this party has commenced the construction of one machine and three drying presses, and will shortly put up four more machines and twelve presses, to complete facilities for manufacturing on a large scale. According to the French law these machines are necessarily built in France."

The Edison Electrical Lamp.

To the Editor of the Scientific American:

I confess to no small degree of surprise at the article in your last edition, by Messrs. Morton, Mayer, and Thomas, on some electrical measurements of Edison's last lamp. I read the article with a great deal of pleasure, until I came to that portion comparing the light by gas from five pounds of coal with that by electricity from the same weight of coal, as developed in Edison's lamp, and my pleasure would not have been diminished, nor my surprise excited, if these gentlemen had compared the effect of that amount of gas used in *twelve* burners (instead of five) with twelve electric lamps. Messrs. Morton, Mayer, and Thomas certainly know that gas suffers nearly if not quite as much by subdivision as electricity, and why they should use a less number of gas burners than electric, is not at all clear. Let them give us the comparison between the two on an equal basis, and I apprehend there will be quite a difference in the figures.

It must be tolerably clear by this time that Edison's idea is the subdivision of the light, to make it practicable for domestic use, and I think he is entitled to great credit for having produced a lamp that will give us twelve such lights at an expenditure of only one and two thirds horse power, assuming Professor Morton's figures to be correct. And it would seem that we might expect men of national reputation, such as these gentlemen possess, to be just in criticising the results obtained by the advance guards of science.

W. A. CRAWFORD.

San Antonio, Texas, April 13, 1880.

Bleaching Teeth.

Dr. W. H. Atkinson, D.S., of this city, gives the following directions for treating discolored teeth: To bleach a tooth discolored by loss of its pulp: Carefully clean it out to the end of the root, going *through* the apex into the *always present latent abscess* at the end. After drying out as well as you can, proceed to fill nicely all the length of the canal in the root and the pulp chamber with oxychloride of zinc.

As soon as it is well hardened excavate out all the discolored dentine that can be spared without weakening the tooth. Then fill the nerve chamber with powdered alum, and wet it with Labaraque's solution of chloride of sodium (such as the laundress uses in washing). This will bleach any tooth that is stained by vegetable color. Now dry well and fill with such shade of oxide of zinc as will restore normal color. When hard cut out the surface and cover with gold. In case iron be the color agent, it may be removed by dissolving a few crystals of oxalic acid in the cavity; afterward proceed as before directed.

Faithfulness in following these instructions, the doctor says, will result in satisfaction to patient and practician, by perseverance.

NEW CORN GRATER.

We give herewith an engraving of an improved device for extracting pulp from green corn, recently patented by Mr Geo. Wood, 15 Warren street, Trenton, N. J. It is a very simple device, and it seems to be just what is needed for the purpose.

The curved upright metal standard is provided with jaws and a thumbscrew for securing it to the table, and supports at the top two parallel blades, one serrated, the other plain. These blades are made in one piece with the standard, and are slightly concaved to conform to the shape of the ear of corn.

The corn to be grated is moved across the blades, the toothed blade first tearing open the kernels and the plain one pressing out the pulp, which falls into the vessel below. The curved standard readily admits a bowl or dish under the blades, and the clamping screw holds the device steadily while in use.

This useful little instrument makes the operation of grating rapid and easy. The pulp obtained by this instrument

WOOD'S CORN GRATER.

is entirely free from hulls, and may be used in a great variety of dishes. The grater is tastefully and substantially made of galvanized or tinned malleable iron.

For further particulars address the inventor as above.

THE BABCOCK & WILCOX WATER TUBE BOILER.

[*Continued from first page.*]

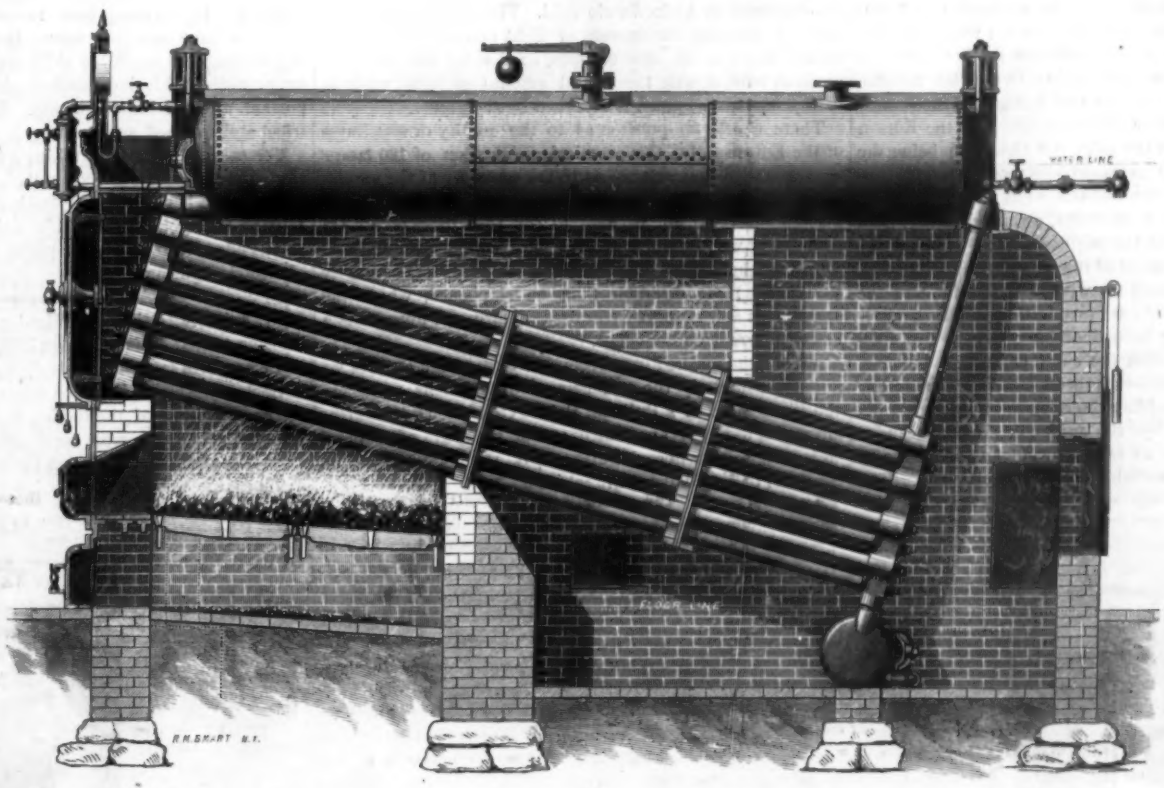
and the products of combustion pass up between the tubes into a combustion chamber under the steam and water drum; from there they pass down between the tubes, then once more up through the spaces between the tubes, and off to the chimney The water inside the tubes, as it is heated, tends to rise toward the higher end, and as it is converted into steam—the mingled column of steam and water being of less specific gravity than the solid water at the back end of the boiler—rises through the vertical passages into the drum above the tubes, where the steam separates from the water, and the latter flows back to the rear and down again through the tubes, the circulation being perfect and constant. As the passages are all large and free, this circulation is very rapid, sweeping away the steam as fast as it is generated, and supplying its place with water, the heat of the fire is absorbed to the best advantage. There is a thorough circulation of the water throughout the boiler, and a consequent equalization of temperature; this prevents, to a great degree, the formation of deposits or incrustation upon the heating surfaces, carrying them away and depositing them in the mud drum, whence they are blown out in the usual way. The steam is taken out at the top of the steam drum near the back end of the boiler after it has thoroughly separated from the water.

Among the many advantages which accrue from this peculiar construction the following are most prominent: a thin heating surface in the furnace; joints removed from the direct action of the fire; a large draught area; complete combustion; a thorough absorption of the heat; an efficient circulation of water; rapid generation of dry steam; steadiness of water level; freedom from injurious effects of expansion; safety from explosion; accessibility for cleaning; ease of transportation.

The advantages hereenumerated are not merely theoretical, but they have been actually demonstrated by the use of more than 35,000 horse power, extending over a period of twelve years, under a great variety of circumstances.

The Singer Manufacturing Company have forty of these boilers, Messrs. Matthiessen & Wiechers have twenty-five, and they are to be found in many of the largest sugar refineries and manufactories of all kinds in this and other countries, one concern having as many as 4,650 horse power in use.

The boiler fronts and the design and arrangement of the fixtures and fittings evince good taste and judgment, and are features which attract the attention of engineers and purchasers. Messrs. Babcock & Wilcox, of No. 30 Courtlandt St., New York, will furnish our readers with any further particulars.



SIDE ELEVATION OF THE BABCOCK & WILCOX WATER TUBE BOILER.

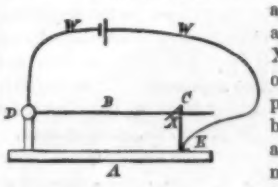
Heavy Damages for Patent Infringement.

In the suit of Christopher C. Campbell against Postmaster James, Charles Eddy, Horace T. Caswell, and Samuel R. Claxton to recover profits for the use of a patent invention in the New York Post Office for the cancellation of postage stamps and the stamping thereon of the date at one blow of the hand, Judge Wheeler in the United States Court has rendered a decision on the Master's report, mulcting Postmaster James in $63,000. This amount, the court finds, was saved in the expenses of the office by the use of the patented article, and such amount the plaintiff is entitled to as damages for the infringement of his patented rights. "The postmaster did this as such," the judge says, "but he was not obliged to do it. He could have refused the office, or resigned it, or have left this patent alone. He was not subject to any restraint, physical or moral, that he could not make subservient to his own choice. His choice was to use this invention and to make this gain. When made it belonged to the relator. Justice can only be done by requiring the defendant to restore the gains to those to whom they belong and leave him to be protected as the law provides, and in doing this no injustice will be done to any one." The judge concludes by ordering that a decree be entered that Postmaster James pay to the clerk of the court $63,000 within twenty days from the entry of the decree for the benefit of the other parties to the suit.—*N. Y. Evening Post.*

The Electrical Adhesion of Metal Contacts.

Workers with telegraph apparatus have often observed a sticking action between two metal contacts (such as the tongue of a "relay") across which a current of electricity is passing; but no experimental study of the phenomenon had, as far as we are aware, been made of the phenomenon till Mr. Stroh, the eminent mechanician, took it up. The results of his recent researches on this subject were recently communicated to the Society of Telegraph Engineers, when some exceedingly interesting experiments were shown by him.

The accompanying figure is a rough sketch of Mr. Stroh's apparatus for showing the adhesion. The metal contact, X, is formed at the crossing of a wire, B, which is supported at one end, D, and a bent wire, C, of the same or another metal, as the case may be. The current from a single bichromate cell is sent across the contact by connecting the poles of the cell by wires, W W, to the mercury contact cups, D E, connected to the wires; and A is a base board supporting the contact. The wire, B, is twelve inches long, and it ought to be fine enough to present a sharp point of contact to C. In fact, the most adhesive contact is formed by two knife-edges crossing one another. The contact must also be perfectly clean and polished. On pressing B against C with a very steady hand the passage of the current will cause the two to adhere together; and they will continue to adhere though the current be taken off. The rapid making and breaking of the current even does not dislodge B. At every make and break, however, a "click" is heard, which is louder on making than on breaking.



To measure the force of adhesion Mr. Stroh has constructed a modification of the above apparatus, in which the rod, B, is made into a kind of steelyard, along which a weight of German silver is slid until it pulls asunder the two contact edges which are stuck together by the current. These edges are beveled to angles of 45°, and they were made of different metals in order to get comparative results.

The following table shows the strength of the electric joint produced by the current from two bichromate cells of the ordinary globular form sold by instrument makers:

Contacts of	Sustained grammes.
Copper	0·15
Silver	0·15
Aluminum	2·5
Brass	8·5
Zinc	11·0
Tin	14
Gold	17
Lead	18
German silver	28
Platinum	42
Iron	85
Steel, soft	100
Steel, hard	225

It will be remarked that copper and silver contacts being the best conductors give the lowest adhesive force. This is explained by Mr. Stroh on the hypothesis that the sticking is due to a partial fusion and welding of the points of contact by heating due to the passage of the current. Copper and silver, offering little resistance to the passage of the current, are, therefore, very feebly heated or fused; hence there is only a slight adhesion. The adhesive power of the joint does not, however, strictly follow the relative resistances of the metals, owing probably to the metals being of different degrees of hardness; lead, for instance, being much softer in the contact edge than platinum, and, therefore, more liable to be flattened out by the shock of meeting. It is not so easy to account for the extraordinary difference between hard and soft steel, the latter supporting less than one-half the weight supported by the former.

There is little doubt, says *Engineering*, that welding is the true cause of this adhesion, for the microscope plainly shows the fused edges of the contact. The result of a continued application of the current seems to be a hardening of the contact, as if it were plunged in water or tempered. This effect naturally reminds us of Mr. Edison's experiments on the shrinkage and consequent hardening of wires by passing currents through them.

In concluding his observations Mr. Stroh drew attention to the fact that the adhesion was, perhaps, chiefly due to the breaking of the current, which was always attended by a spark. Mr. W. H. Preece remarked that if the current were interrupted often enough, the resulting clicks would merge themselves into a continuous hum; and alluded to the obvious connection between such a contact and the microphone.

Distinguishing Lights for Lighthouses.

In a letter to the London *Times*, Sir W. Thomson recommends: (1) A great quickening of all revolving lights. (2) The application of a group of dot-dash signals to every fixed light. (3) The abolition of color as a distinction for lighthouse lights, except for showing dangers, channels, and ports by red, white, and green sectors.

His proposal is to distinguish every fixed light by a rapid group of two or three dot-dash eclipses; the dot of about half a second duration, the dash three times as long, with intervals of light, about half a second each, between the eclipses of the group, and of five or six seconds between groups. The distinction by color alone ought to be prohibited for all lighthouse lights, on account of its liability to be confused with ships' and steamers' sidelights.

Of about one hundred and twenty revolving lights on the English, Scottish, and Irish coasts there are in all eighteen, in which the periods are ten seconds or less, and the times of extinction seven seconds or less. In these quick revolving lights, the place of the light is not practically lost during darkness; the eye, sweeping deliberately along the horizon, with or without the aid of a binocular, "to pick up the light," passes over less than its own field of view within the period of the light, and thus finds it almost as surely as if it were fixed.

A Case of Melanosis in Philadelphia.

For some months a Philadelphia physician has had under treatment an infant afflicted with the rare disease, melanosis, in an aggravated form. The child was born with a fair complexion, dark eyes, and brown hair. Soon after birth he began to turn dark of skin, the color deepening from yellow to saffron, and finally to black. The color was uniform all over the body, except at the joints where it was a little darker, and in the palms of the hands where it was lighter. The once brown hair grew stiff and jet black, and the eyes also grew darker, so that the line between the pupils and the iris could not be distinguished.

In spite of medical treatment the boy became worse, and grew very weak, all the time the color of his skin deepening. At last he became as black as a full-blooded negro. Then he was attacked by convulsions, which grew more frequent and violent until they threatened the child's life. It was in one of these that Dr. Reynolds was called in. He succeeded in curing the spasms, and then devoted his attention to the strange disease which afflicted the child. He at once recognized it as melanosis or pigmentation, which is mentioned in the books in a general way, but there is no case given where it had developed all over the body. This was more than sixteen months ago, the child being then thirteen months old.

Since then the boy has greatly improved, by degrees becoming lighter, until now he is of a light chestnut brown color. The case has naturally attracted much attention from physicians.

THE COLUMBIA.

The new steamship Columbia, just completed at the works of John Roach, at Chester, Pa., for the Oregon Railway and Navigation Company, has been lying at the foot of Wall street in this city for the last few days, taking on cargo and receiving a few finishing touches prior to steaming to the waters for which she is intended. She will ply between San Francisco and Portland, Oregon, and is claimed by her owners to be in all her appointments and conveniences the finest steamship afloat: an opinion which her numerous visitors were generally inclined to accept as justified by fact.

The Columbia is 334 feet in length, 38½ feet beam, 23 feet in depth of hold, and 3,200 tons measurement. She is provided with compound engines, and is expected to make an average speed of fourteen knots. The principal officers are: Captain F. Bolles, First Officer De Wolf, Chief Engineer J. C. Henderson. We are indebted to the courtesy of the last named officer for much of the information here given.

The main dining room is of elegant proportions, with two guests' or communicating rooms at the after end. The interior is finished in hard woods—French walnut, Hungarian ash, and bird's-eye maple—each section being relieved by two small pilasters running up the entire height and finished with handsome mahogany capitals. The vessel is elegantly fitted throughout in the matter of carpets, furniture, and upholstery. Prominent among the newest features is the heating apparatus, consisting of a register in every room, supplied with air driven in by an engine and controlled by the occupant of the room. In hot weather it can be utilized for cold, and in cold weather for hot air, thus securing perfect ventilation and doing away with the disagreeable odor of steam heaters and leakage in the rooms. But the greatest innovation is the adoption of the Edison electric light throughout the ship, the Columbia being the pioneer in this great, and to passengers most agreeable improvement. These lights are maintained by four of Edison's dynamo machines in the engine room, arranged so that each line is under command of the engineer. The lights of the state rooms are under control of the steward on the outside. All of the rooms are fitted up with electric calls, and the offices, smoking room, etc., are provided with telephones—the smoking room being in connection with the steward's room, and the captain's with the chief engineer's, purser's, and steward's. Among other improvements are an electric telltale on the bridge, enabling the captain to tell, by simply pressing a button, whether the engine is going ahead or back, and at what speed, so as to prevent any accidents by mistaken signals from the bridge to the engine room. The steering gear has connection with the freight hoister, but with self-acting attachment. The elevators for discharging cargo are new in design, and the running engines at the ports are arranged so that a truck loaded with freight runs from the lower hold out to the dock entirely by steam.

The Maxim electric head light is of novel construction, and is supplied by a current from one of Maxim's dynamo machines placed between decks.

The four Edison machines are arranged along one side of the engine room, as shown in Fig. 2. One of them is a dynamo electric machine used in exciting the field magnets of the others. The several circuits extending from these machines are controlled by a switch board seen at the farther side of the engine room. The state rooms on the upper and lower decks are on separate circuits; so also are the saloons. This arrangement admits the employment of the light as a signal to indicate when the time approaches for extinguishing the lights altogether, by simply breaking the circuit for an instant ten minutes before the prescribed retiring hour.

Fig. 3 gives a good idea of one of the elegant state rooms provided with an Edison lamp pendent from the ceiling, and Fig. 7 shows the style of lamp adopted for the dining saloon; the lamps in the grand saloon are on the same general plan, differing a little only in form. The lamp fixture, as will be noticed, is of the same form as those used for oil lamps, and by an ingenious mechanical contrivance they are adapted to either the electric or oil lamp, so that should the electric lamp in any way fail the oil lamps may be immediately substituted. The electric lamp globes are frosted lightly by dipping them in hydrofluoric acid. The globe thus treated seems to increase the amount of light proceeding from the incandescent horse shoe carbons, so that by some they are credited with double the actual amount of light, while in reality one-twenty-third is absorbed by the globe.

There can be no question as to the quality or steadiness of the Edison light, this practical application of 120 lamps having settled that point. As to the economy of the system of lighting and the durability of the lamps Mr. Edison and his supporters do not hesitate to say that these points are sufficiently well established to insure commercial success. Certainly there is no place where a lamp of this character would be more desirable than on shipboard, where the apartments are necessarily limited in size and pure air is a matter of great consequence.

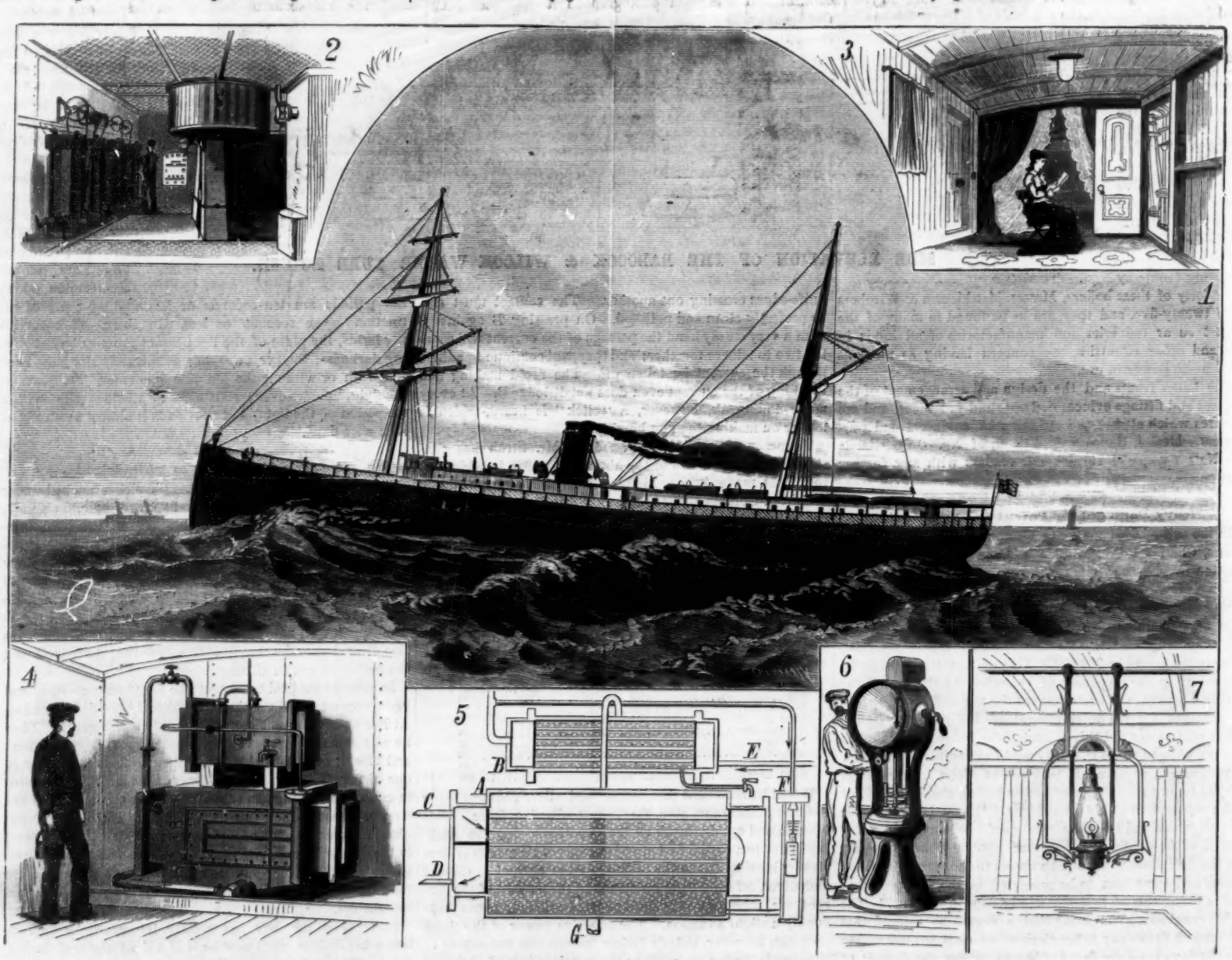
Among the marked improvement in state room fixtures we notice particularly the arrangement of the berths, which are similar to those of a Pullman Palace Car. When the berths are not in use they are folded out of the way, affording a cosy little room where one may enjoy the comforts or discomforts of a sea voyage in seclusion.

The system of water supply for fire and other purposes is most complete. Pipes lead to all parts of the vessel and terminate in lengths of hose conveniently placed, and in the pipes a constant water pressure is maintained on much the same plan as the well known Holly system of water supply; so that all that is necessary to obtain a copious discharge of water in any part of the ship is to open a valve. The still by which a constant supply of fresh water is maintained is new in its construction and arrangement. Fig. 4 shows the exterior, and Fig. 5 is a vertical longitudinal section showing the interior. The still, A, is traversed longitudinally by flues through which steam circulates, entering through the pipe, C, returning to the boiler through the pipe, D. The still, A, communicates with the condenser, B, by a pipe entering the top of the latter. The condenser is traversed lengthwise by tubes through which cool water passes, entering by the pipe E, and leaving by a vertical pipe at the opposite end. A portion of the water used in cooling the condenser is taken to the still through the float valve, F, which keeps the water at a uniform level. The still is provided with a blow-off, G, for clearing out the salt; it also has a surface blow-off. This apparatus is capable of supplying 1,200 gallons of pure fresh water daily.

In Fig. 6 is shown the electric head light, which consists of a Maxim electric lamp, having its arc in the focus of a parabolic reflector, which may be turned in any direction and a cone of light projected a long distance. When directed across the East River from its present position it illuminates the buildings in Brooklyn almost as brightly as sunlight. In building this magnificent steamer nothing seems to have been forgotten. It is as complete as the best engineering and inventive skill can make it. The engines are provided with independent air pumps and other important modern improvements. Everything has a symmetrical and finished appearance.

The cargo which she is taking on consists largely in railroad supplies, thirteen locomotives and 200 cars being included. On her way to her destination she will coal at Rio Janeiro, and while there will be exhibited to the Emperor Dom Pedro, who takes an especial interest in the progress of electric lighting.

Mr. John M. Bailey, of Winning Farm, Billerica, Mass., informs us that he is now (April 24) feeding his milch cows and ewes with lambs exclusively upon corn fodder ensilaged in September last. His silos were opened December 3, and the preservation of the fodder is as perfect now as then. Mr. Bailey is doing great service to the agricultural world in demonstrating to American farmers the advantages of this method of keeping fodder.



THE NEW STEAMSHIP COLUMBIA.

NATURAL HISTORY NOTES.

Automatic Movements of a Fern.—Dr. Asa Gray, in *Coulter's Gazette*, says: "Mr. E. J. Loomis, of the Nautical Almanac Office, Washington, recently showed me a phenomenon which, I suppose, has never before been noticed, and which is commended to the attention of botanists. A tuft of *Asplenium trichomanes*, gathered last autumn in the mountains of Virginia, is growing in his house, in a glass dish. About two months ago he noticed that one of the fronds—a rather short and erect one which is now showing fructification—made quick movements alternately back and forth, in the plane of the frond, through from 20° to 40°, whenever the vessel was brought from its shaded situation into sunlight or bright daylight. The movement was more extensive and rapid when the frond was younger. When I saw it on the 23d of January, its compass was within 15°, and was about as rapid as that of the leaflets of *Desmodium gyrans*. It was more rapid than the second hand of a watch, but with occasional stops in the course of each half vibration. This was in full daylight next a window, but not in sunshine. No movement had been observed in the other fronds, which were all sterile and reclining, with the exception of a single one which was just unfolding, in which Mr. Loomis thinks he has detected incipient motion of the same kind." This little fern is very common, and it is easy to obtain it and set it growing. The matter is worthy of further investigation.

Vitality of Mollusks.—Very extraordinary statements are found in the books regarding the vitality of shell fish. Dr. Woodward states that in June, 1850, a living pond mussel was sent to Mr. Gray, of the British Museum, from Australia, which had been more than a year out of water. The pond snails (*Ampullariæ*) have been found alive in logs of mahogany from Honduras; and M. Cailland carried some alive from Egypt to Paris packed in sawdust. Indeed, it is not easy to ascertain the limit of their endurance; for Mr. Laidlay, having placed a number in a drawer for this purpose, found them alive after five years, although in the warm climate of Calcutta. In the ordinary land snails such cases are still more remarkable. Some of the large tropical species of *Bulimus*, brought from Valparaiso by Lieut. Graves, revived after being packed, some for thirteen, others for twenty months. Mr. Wollaston had informed Dr. Woodward that specimens of two Madeira snails (*Helix papilio* and *tectiformis*) survived a fast and imprisonment in pill boxes of two years and a half, and that a large number of the small *H. turricola*, brought to England at the same time, were all living after having been inclosed in a dry bag for a year and a half. But the most interesting example of resuscitation occurred to a specimen of the Desert snail from Egypt, chronicled by Dr. Baird in the "Annals of Natural History." This snail was fixed to a tablet in the British Museum on the 25th of March, 1846; and on the 7th of March, 1850, it was observed that he must have come out of his shell in the interval (as the paper had been discolored apparently in his attempt to get away); but finding escape impossible, had again retired, closing his aperture with the usual glistening film. This led to his immersion in tepid water and marvelous recovery. Dr. S. Lockwood, in the *American Naturalist*, for March, adds another remarkable instance of vitality in the case of *Helix aspera*. He says: "August 24, 1878, I ascended an old castle, or square tower, near Queenstown, Ireland, and found between the stones a number of the common garden snail of Europe (*H. aspera*). I secured three specimens, and having wrapped them in paper, put them in my trunk. On my arrival home, October 28, on looking for my treasures, I found that one was crushed. The other two I dipped in water a few seconds, then put them in the fernery, and was delighted to see them crawl about. I could not get them to feed. One died in the following May, having been in confinement nine months. The other died in November, 1879, having lived thirteen months without food.

Recent Botanical Discoveries in America.—Prof. Eaton reports in the *Bulletin of the Torrey Botanical Club*, the discovery in Nova Scotia, by Miss Elizabeth G. Knight, of this city, of *Schizæa pusilla* and *Littorella lacustris*. The rare and interesting little fern, *Schizæa*, was only known before to occur in the pines of New Jersey, although Prof. Gray states that he has seen specimens of it in La Pylaie's herbarium at Paris, collected sixty years ago, and which are ticketed as having been detected in Newfoundland. The *Littorella* was found for the first time in America by Mr. Macoun, in 1869, on an island in Gulf Lake, Canada. It was found again by Mr. Pringle at the northern end of Lake Champlain, a short time only before Miss Knight found it in Nova Scotia; but these are the only records thus far of its discovery in America. Until these discoveries the plant, unlike most aquatics, had apparently a very restricted range of distribution, being confined chiefly to Central and Northern Europe, although not uncommon in many of the lakes and streams of Scotland, and occurring, though rarely, in England.

DUST FIGURES.

BY BURR NOBLE.

I was very much interested in reading the letters in Nos. 5 and 6 of the current volume, SCIENTIFIC AMERICAN, on crystallizations found in telescopic objectives, and was reminded that during ten years' use of surveying instruments I have always noticed this phenomenon in all old instruments which were exposed to very cold weather; I therefore attributed it entirely to freezing.

CURIOUS DUST FIGURES.

This subject has brought to my mind a very peculiar arrangement of dust particles found in a common water pitcher. This vessel was filled with water, and had stood near a window, unused, for about three months, during a portion of the spring and summer, in Kansas. In pouring the water out, my brother noticed the crystallized appearance of the dirt in the bottom, and carefully preserved the sediment and afterward photographed it. At that time (about eight or nine years ago) it attracted a good deal of attention, but none were able to explain the peculiar formation in a satisfactory manner, as no freezing weather occurred during the time the pitcher was standing.

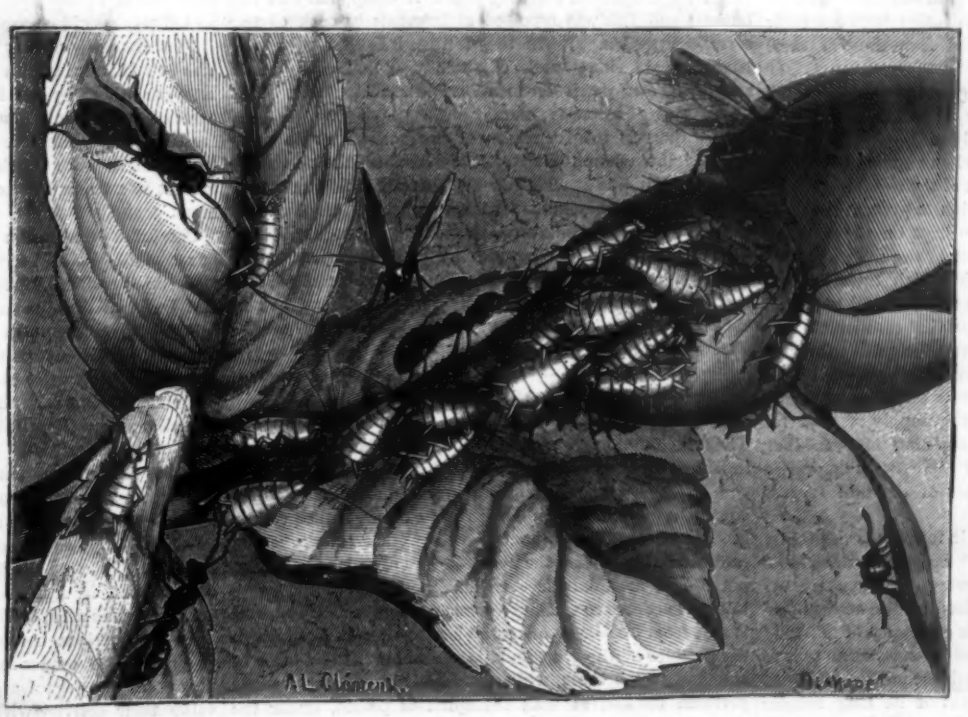
A Many-Named Cereal.

Considerable attention has been called of late to an alleged new cereal, chiefly on account of the notice taken of it by the Kansas Board of Agriculture. Lately the Produce Exchange of this city received from California a specimen of the grain, with a communication with regard to it from an expert in cereals. The letter pronounced the grain no novelty, since it was cultivated in Europe as early as 1596.

It has been in the habit of coming forward every few years under a new name, having already been known successively as Egyptian corn, ivory wheat, Guinea corn, and Indian millet. Each attempt to foist it upon the public has been a clear case of false pretenses. It is really no other than the drooping sorghum (*Sorghum cernuum*), and differs from common sorghum principally in the fact that the stock bearing the head or ear droops. This is not caused by the weight of the ear, as the stalk begins to turn almost from the moment the ear begins to form. It is not rice or anything akin to it, and is not a native of South America. It has been repeatedly tried in all sections of the country, but has never succeeded in obtaining a foothold, because the American farmer will not be induced to accept it as a substitute for wheat, to which it is vastly inferior. Among the semi-barbarous peoples of the East Indies and Africa it forms a staple article of food, owing to the facility with which it can be prepared for the table. Unripe, it is cooked and eaten like green corn. Ripe, it can be boiled the same as rice. Flour is also made from it by crushing. It has abundant foliage of a grayish-green color, and grows to a height of seven feet, and a field of it consequently presents an odd appearance. The writer has nothing to say on the question of its adaptability to dry, arid sections where other cereals cannot grow. The specimen at the Exchange consists of an oblong bunch of grains about six inches long and three to four in diameter. The grains are about the shape of barley, but twice as large, ivory white with a black speck, and almost as hard as corn.

ANTS AND THEIR MILCH CATTLE.

The instincts of the ant are, indisputably, more extraordinary than those of any other in the whole range of animated nature. The ancients magnified them into fabulous miracles. Pliny talks of an Indian ant as big as an Egyptian wolf, of the color of a cat, which entered the bowels of the earth in search of gold, of which they are said to have been plundered during the winter by the human inhabitants of those regions. But exaggeration and credulity apart, the real habits and proceedings of these insects are so extraordinary that they would stagger our belief if not confirmed by the past observations of such naturalists as Huber and Latreille, and those of Sir John Lubbock and others of our own day. One of the most singular traits in their manners and customs is that of keeping and feeding certain other insects, from which they extract a sweet and nutritious liquid, in the same way as we obtain milk from cows. There are two kinds of insects from which the ant tribe abstract this juice—the aphides, or plant lice, and the gall insects. Linnæus, and after him other naturalists, have called these insects the milch cattle of the ants; and the term is not inapplicable. In the proper season, any person who may choose to take the trouble to watch their proceedings may see, as Linnæus says, the ants ascending trees that they may milk their cows, the aphides. The substance which is here called milk is a saccharine fluid, which these insects secrete, it is scarcely inferior to honey in sweetness, and issues in limpid drops from the body of the insect, by two little tubes placed one on each side just above the abdomen. (See engraving.) The aphides insert their suckers into the tender bark of a plant, and employ themselves incessantly in absorbing its sap, which, having passed through the digestive system of the insect, is discharged by the organs just mentioned. When no ants happen to be at hand to receive this treasure, the insects eject it to a distance by a jerking motion which at regular intervals they give their bodies. When the ants, however, are in attendance, they carefully watch the emission of the precious liquid, and immediately suck it down. The ants not only consume this fluid when voluntarily ejected by the aphides, but what is still more surprising, they know how to make them yield it at pleasure, or in other words, to milk them. On this occasion the antennæ of the ants discharge the same functions as the fingers of a milk maid; with these organs, moved very rapidly, they stroke the abdomen of an aphis first on one side and then on the other, and immediately a little drop of the much coveted juice issues forth, which the ant eagerly conveys to its mouth. A single aphis has been known to give it drop by drop successively to a number of ants that were waiting anxiously to receive it. The milk of one aphis having been exhausted, the ant proceeds to treat others in the same manner, until at length perfectly satiated, and with belly swelled almost to bursting, it lazily descends the plant and seeks its nest. A still more singular fact connected with this branch of the natural economy of these insects remains to be stated.



ANTS AND THEIR MILCH CATTLE.

These cows are not always considered the common property of a whole tribe, but, on the contrary, some of them are appropriated to the exclusive use of the inhabitants of a particular hill or nest; and to keep these cows to themselves they exert all their skill and industry. Sometimes the aphides inhabiting the branches of a particular tree, or the stalks of a particular plant, are thus appropriated; and if any vagrant

foreigners attempt to share this treasure with its true owners, the latter, exhibiting every symptom of uneasiness and anger, employ all their efforts to drive them away. Some species of ants go in search of these aphides on the vegetables where they feed; but there are others, such as the yellow ant, which collect a large herd of a kind of aphis, which derives its nutriment from the roots of grass and other plants.

These milch kine they remove from their native plants and domesticate in their habitations, affording, as Huber observes, an example of almost human industry and sagacity. On turning up the nest of the yellow ant this naturalist one day saw a variety of aphides either wandering about in the different chambers or attached to roots of plants which penetrated into the interior. The ants appeared to be extremely jealous of their stock of cattle; they followed them about and caressed them, whenever they wished for the honeyed juice, which the aphis never refused to yield. On the slightest appearance of danger they took them up in their mouths and gently removed them to a more sheltered and more secure spot. They dispute with other ants for them, and, in short, watch them as keenly as any pastoral people would guard the herds which form their wealth. Other species, which do not gather the aphides together in their own nest, still seem to look on them as private property; and, what is yet more extraordinary, they inclose them, as a farmer does his sheep, to preserve them not only from rival ants, but also from the natural enemies of the aphis. If the branch on which the aphides feed be conveniently situated the ants have recourse to a very effectual expedient to keep off all trespassers: they construct around the branch containing the aphides a tube of earth, or some other material, and in this inclosure, formed near the nest and generally communicating with it, they secure their cattle against all interlopers. The brown ant has been observed by Huber to build a chamber around the stem of a thistle in such a way that the stalk passed through the center, so that from their ant-hill they had only to climb the thistle stalk in order to enter this cattle-fold, which was suspended in mid-air. The interior, smooth and compact, was entirely formed of earth; it contained an extensive family of insect-cows, sheltered from the inclemencies of the weather, and protected from their enemies. These edifices are not always constructed near the bottom of the thistle stalk; Huber once saw one at a height of five feet from the ground. "These proceedings," says he, "are by no means common; we cannot attribute them to a habitual routine." Indeed, the modes of preserving their cattle seem to be as various as those practiced by man.

Some ants receive their food from the aphides which suck the juices of the common plantain, and these at first take their station near the flower of the plant; as soon as the flowers wither these insect-cows take shelter under the radicle leaves; whereupon the ants that before had climbed up to them now surrounded them with a mud wall, and, making a covered gallery by way of communication between their nest and the "paddock," extract food from them at their convenience and pleasure.

During autumn, winter, and spring many species of ants keep aphides. Indeed, in winter they would be exposed to the danger of famine did they not rely for food on their cattle; for though they become torpid when exposed to intense cold, yet, for the most part, the depth of their nests preserves a temperature for them sufficiently high to prevent this contingency. Their milch cows are then kept on the roots of the plants which penetrate the interior of the nest, and furnish an abundant supply of liquid, in which their keepers delight. And not only is the full grown animal kept, but its eggs are watched and guarded with that care which warrant us in supposing that the ant knows their full value. It is of real consequence to the ants that the hatching of the eggs of the aphides should take place as early in the spring as possible, in order to insure an early supply of food for their colony; and with the view of hastening this event they deposit them in the warmest part of their dwelling, and in fine weather bring them to the surface of the nest to give them the advantage of the sun.

Plant lice, or aphides, differ much in form, color, clothing, and in the length of the honey tubes. Some have these tubes quite long, as the rose louse (*Aphis rosæ*) of the accompanying engraving, which is green, and has a little conical projection, or stylet as it is called, at the extremity of the body between the two honey tubes. These insects seem to love society, and often herd together in dense masses, each one remaining fixed to the plant by means of its long tubular beak; and they rarely change their places till they have exhausted the first part attacked. The attitudes and manners of these little creatures are extremely amusing. When disturbed, like restive horses, they begin to kick and sprawl in the most ludicrous manner. They may be seen, at times, suspended by their beaks alone, and throwing up their legs as if in a high frolic, but too much engaged in sucking to withdraw their beaks. As they take in great quantities of sap they would soon become gorged if they did not get rid of it through the little tubes at the extremity of their bodies. When one of them gets running-over full it seems to communicate its uneasy sensations, by a kind of animal magnetism, to the whole flock, upon which they all, with one accord, jerk upward their bodies and eject a shower of the honeyed fluid. The leaves and bark of plants much infested by these insects are often completely sprinkled over with drops of this sticky fluid, and which on drying become dark colored, and greatly disfigure the foliage. This appearance has been styled "honey-dew," but should not be confounded with another similar production observable on plants after very dry weather, which has received the same name, and which consists of an extravasation or oozing of the sap from the leaves.

Snakes Eating Fish.

For a number of years past it has been my custom, because unable to find any better way to dispose of my summer leisure, to do a good deal of fishing in the Potomac river, sometimes in the immediate front of the city, sometimes at the Little and Big Falls above, and sometimes at the Four Mile Run below. I have generally used live bait, there being minnows in any quantity along the edges of the river. Three summers ago I went to catch minnows at the mouth of a small run called Gravelly Creek, situated on the west bank of the river, just at the foot of the Arlington estate. A short distance north of the run is the once quite celebrated Arlington Springs, which is still a place of resort for large numbers of Sunday visitors from the city. To reach the springs, except by boat, it is necessary to cross Gravelly Creek near its mouth, or go quite a long distance around the creek. To enable parties to cross the creek at the mouth, a passageway has been made by a kind of loose dam of stones. At low water the creek here is some forty feet wide, but at full tide it is fully sixty feet, and four or five feet deep. The loose stones form quite an impediment to the tide, so that, when the tide is rising, the water on the river side of the dam is several inches higher than the water on the other side, and flows through and over the loose stones quite rapidly, and the reverse is the case when the tide is falling. Vast numbers of minnows are to be found at all times in the marsh along the river banks, and as the tide rises they seek the runs to be found here and there to avoid the white and yellow perch which prey upon them, and it is while they are making up the creek that I catch the quantity I want.

One day, while catching minnows as usual, I noticed a number of snakes, the common water moccasin, approaching the dam or footway of stones. The water yet lacked several inches of reaching the top of the stoneway, although it was rushing in quite rapidly and carrying with it many bull-minnows and small white perch that were unable to resist it. Watching the snakes, I saw one after another reach the dam and take their station upon it, submerging themselves all but their heads, which were raised about an inch above the water and pointed in the direction of the incoming tide. In this position I counted seventeen snakes, arranged at uneven intervals, in a space of less than sixty feet. I came to the conclusion at once they were fishing, and watched them with a good deal of interest. Pretty soon I saw one head strike forward, going under the water, reappearing in a moment with a very large bull-minnow in its mouth. The snake immediately loosened its hold upon the rocks and swam for the shore, reaching which it disappeared in the bushes; and this was repeated at intervals by each of the seventeen snakes. When they returned from the bushes, having made short work of their "catch," each snake sought his own particular location on the rocks, there being no clashing of interests there.

Now, how is this for reason or instinct? How do these snakes know where to locate themselves, and the particular stage of the tide at which to start on their fishing excursion? How do they know that a number of minnows will be swept over the miniature falls made by the rocks? These are questions that go beyond my comprehension, and I leave them for others to answer. But the facts remain, and any one who will take the trouble may verify them at any time during the summer by a visit to Gravelly Creek.—*Forest and Stream.*

Uses of the Potato.

In France farina is largely used for culinary purposes. The famed gravies, sauces, and soups of France are largely indebted for their excellence to that source, and its bread and pastry equally so, while a great deal of the so-called cognac, imported into England from France, is the product of the potato. Throughout Germany the same uses are common. In Poland the manufacture of spirits from the potato is a most extensive trade. "Stettin brandy," well known in commerce, is largely imported into England, and is sent from thence to many of her foreign possessions as the produce of the grape, and is placed on many a table of England as the same, while the fair ladies of our country perfume themselves with the spirit of potato, under the designation *eau de Cologne*. But there are other uses which this esculent is turned to abroad. After extracting the farina the pulp is manufactured into ornamental articles, such as picture frames, snuff boxes, and several descriptions of toys, and the water that runs from it in the process of manufacture is a most valuable scourer. For perfectly cleansing woolens and such like articles, it is the housewife's panacea, and if the washerwoman happens to have chilblains she becomes cured by the operation

The Site for the Obelisk.

At a meeting of the New York Department of Parks, April 5, the site for the Egyptian obelisk, soon to be transshipped at Alexandria, was finally decided. It is to stand on a natural knoll in front of the new building of the Metropolitan Museum of Art, on the west side of the main carriage-way. This will add a new attraction to Central Park, and prevent the monolith from being dwarfed by surrounding buildings, as it would have been in any of the smaller parks or squares of the city.

Why Is Arsenic a Poison?

The question of how arsenical compounds act as poisons has been discussed by Binz & Schulz as follows: Liebig seems to have been, up to the present time, the only author who had advanced any theory as to the poisonous action of arsenic. In the first edition of his work, that of 1843, on the relation of chemistry to agriculture and physiology, he states his views essentially as follows: Arsenious acid and corrosive sublimate possess in a high degree the power of forming with albumen solid compounds. When these substances are taken internally the albumen of the living tissues thereby loses the power of undergoing those transformations which are necessary to their existence. In this way the life of important parts is destroyed and the death of the whole being is the result.

Liebig did not afterward uphold this theory, although it is still to be found in some chemical handbooks. It has been abandoned for this reason, that a solution of arsenious acid, or of one of its salts, does not form the solid compounds (albuminates) as Liebig at first supposed, while this is undoubtedly the case with corrosive sublimate among others. There is, in fact, no single case known where arsenious acid produces any stronger precipitation of the constituents of the body than does carbonic acid for example.

This non-existence of an arsenical albuminate is also proven by the fact that an animal can be poisoned by the introduction of an arsenical solution without the spot where it was introduced, even if it is the extremely sensitive conjunctiva of the eye, showing anything more than a slight redness. In the interior of the body, on the other hand, the changes are very clearly seen. The stomach is the central point of all these, even in cases where no trace of the poison has come into direct contact with it. Anatomical investigations show us that those very tissues of the body which are especially capable of taking up the oxygen of the blood are the furnaces of disturbances.

The neutral salts of arsenic acid are just as poisonous as those of the arsenious acid, and some say more so. Arsenious acid can readily be converted into arsenic acid, and the latter passes still more easily into the former. The latter process is aided by albumen in general; the former only by the *living* albumen of plants and animals.

The experiments were first made outside of the organism with single parts. White of egg and fibrin from warm-blooded animals were digested with arsenic acid at the temperature of the body, and were found to reduce it to arsenious acid; fresh brains do the same. The tissues of the digestive organs as well as the liver and the undecomposed protoplasm of plants not only reduced arsenic acid to arsenious acid, but also oxidized arsenious acid to arsenic acid. If the tissues which are able to oxidize the lower to the higher acid are previously heated in boiling water, they lose this property. Blood, hæmoglobin, and fresh fat, do not possess either one or the other action.

This double property can be proven in living animals. The two different oxides of arsenic are converted, the one into the other, by the lining of the intestines, which, in cases of poisoning, belong to those parts which are first and most violently affected. On the other hand, those parts which, in life, are touched, or only later and secondarily, are not able to start these changes, especially to oxidize arsenious acid.

Careful and accurate consideration of all the details of our experiments lead to the conclusion that the conversion and reconversion of these acids into one another in the animal body, as first proven by us, causes a violent vibration of the oxygen atoms in the molecules of living albumen, whereby the tissues are corroded until totally destroyed.

In this respect there is a perfect parallelism between nitrogen and phosphorus. Nitric oxide is excessively poisonous. By taking up oxygen it is converted into the violently oxidizing hyponitric acid. It destroys the tissues, while it is in part reconverted with absorption of water into nitric oxide. In the whole reaction the nitrogen takes no direct part. It is merely the inert carrier and distributer of the powerfully aggressive active oxygen atom. Arsenic plays the same rôle here, where it appears as the carrier of active oxygen, that is, it is every instant passing from arsenious acid to arsenic acid, and back again to arsenious acid.

The distinctions between arsenic and nitrogen are only gradual. The oxides of nitrogen attack the parts where they enter the organism; the oxides of arsenic at first envelop their activity within themselves, and it is only by long activity that they are recognized as corrosive without. The active oxygen of nitric oxide instantly tears itself loose, but that of arsenic acid requires some time, and that is the reason why the latter first shows its destructive effects within the organism. That such oxygen atoms possess poisonous properties is evident from the well-known poisonous action of ozone when it passes into the organism except in an exceedingly dilute form. This has recently been shown, too, in the case of chlorates. They give up their three atoms of oxygen to certain constituents of the body, being reduced to chlorides, and thereby act corrosive and destructive to the cells and the blood.

The other members of the nitrogen group show a remarkable coincidence both in their chemical and poisonous properties. Antimony, bismuth, and vanadium pass readily from one degree of oxidation to another. Phosphorus generates ozone in the body as well as in the air, and thus destroys the living albumen. The good effects of these as remedies can also be traced to the action of their active oxygen.—*B. d. d. Ch. Ges.*

THE CHRONOLOGY OF THE TELEGRAPH.

In his critical and laborious review of the origin and development of the electro-magnetic telegraph, with special reference to Professor Joseph Henry's contributions thereto, Mr. William B. Taylor has gone over the literature of this vast subject with great minuteness and thoroughness. We speak of the "development of the telegraph" designedly, and without reference to the world-embracing systems of telegraphic lines, for the record conclusively justifies the assertion of Robert Sabine that the electric telegraph had, properly speaking, no inventor. "It grew up little by little, each inventor adding his little to advance it toward perfection."

The more notable impulses and developments in this long evolution we propose to summarize, following Mr. Taylor throughout.

TELEGRAPHS BY ELECTRICITY.

1774.—Georges Louis Lesage, Geneva, set up the first telegraph line, which consisted of twenty-four insulated wires for the alphabet, each terminating in a pith-ball electroscope, duly lettered, for indicating by its excitation the succession of letters in the message, the transmitting operator using a manual conductor from an electrical machine.

1787.—Mons. Lomond, Paris, employed a single brass wire in connection with pith-ball electroscopes, making use of an alphabet of motions.

1794.—M. Reiser, Geneva, used thirty-six insulated wires for letters and numerals, in connection with a like number of narrow strips of tin foil pasted on glass; the letters and figures were cut in the foil and made visible by the passage of the electric spark.

1795.—Tiberius Cavallo, England, sent explosive and other electric signals through fine insulated copper wire, using Leyden jars, and sending "sparks at different intervals according to a settled plan."

1798.—D. F. Salva, Spain, worked an electric telegraph through the unprecedented distance of twenty-six miles, using a single wire, and the sparks of a Leyden jar for signals.

1816.—Francis Ronalds, England, constructed an experimental telegraph line, of a single insulated wire 8 miles long, operated by an electrical machine, or small Leyden jar. His elementary signal was the divergence of the pith balls of a Cauton's electrometer, produced by the communication of a statical charge to the wire. Lettered dials, rotated synchronously at each end of the line, served, in connection with the pith-balls, to indicate the letter designated by the sender. This dial system was the precursor of Wheatstone's dial telegraph in 1839; House's letter printing telegraph in 1846; and Hughes' printing telegraph in 1855.

1828.—Harrison Gray Dyar, America, constructed a telegraph on Long Island, supporting his wires by glass insulators fixed on trees and poles; the electric signals printed themselves upon litmus paper, the spacing of the marks indicating the letters and other signs. Just as Dyar and his partner Brown were seeking capital to set up a line between New York and Philadelphia, a black-mailing agent, failing to extort the concession of a large share in the enterprise, obtained a writ against the two partners or a charge of conspiracy to carry a secret communication between the cities! The case was never brought to trial, but the enterprise was blocked.

According to Steinheil, these various experiments put it beyond a doubt that frictional electricity might be made a successful means of telegraphic intercourse.

TELEGRAPHS BY GALVANISM.

1808.—The first to apply to telegraphy the galvanic battery introduced by Volta, in 1800, was Dr. Samuel Thomas Von Soemmering, of Munich. He employed the energy of a powerful voltaic pile to bring about the decomposition of water by means of thirty-five gold pins immersed in an oblong glass trough. Each of these electrodes was in connection with one of the thirty-five wires forming the line. The bubbles evolved at these electrodes were received in lettered and figured tubes, and the messages were thus spelled out. In 1810 Soemmering telegraphed through two miles of wire.

1816.—Dr. John Redman Coxe, of Philadelphia, suggested a system substantially the same as Soemmering's (of which he appeared to be ignorant). He also proposed to accomplish the same result by decomposing metallic salts, as was afterwards done.

1843.—Mr. Robert Smith, Scotland, devised a galvano-chemical telegraph carrying out practically the suggestion of Dr. Coxe. At first he used a separate wire for each letter, the message being printed on a strip of paper wet with a solution of ferrocyanide of potassium. Subsequently Mr. Smith reduced his line to a single circuit of two wires, and worked his system through 1,800 yards of fence wire (1846).

1846.—Mr. Alexander Bain, Scotland, patented in England a galvano-chemical telegraph, different in mechanical details, but similar in its chemical record to the system of Smith.

1849.—Prof. Samuel F. B. Morse, New York, patented in this country a telegraph similar to Smith's.

TELEGRAPHS BY GALVANO-MAGNETISM.

1820.—Hans Christian Oersted, Copenhagen, rediscovered the directive influence of a galvanic conductor on a magnetic needle (Romagnosi's observations of the same in 1802 having attracted no attention). The same year (1820) Professor Schweigger, of Halle, made the first real galvanometer; and shortly after Ampère, in Paris, proved experimentally the feasibility of an electro-magnetic telegraph, in which the galvanometer should take the place of the electrometer employed by Lesage.

1823.—Baron Paul L. Schilling, of Cronstadt, Russia, practically applied Ampère's suggestion. In his apparatus signals were produced by five galvanometer needles, provided with independent circuits.

1824.—Peter Barlow, England, experimenting with considerable lengths of wire, to test the practicability of Ampère's suggestion, was convinced that it was impracticable, owing to the rapid diminution of effect (due to increased resistance), by lengthening the conducting wire. Other inconclusive experiments in the same direction were made by Fechter in 1829, and Ritchie in 1830.

1833.—Prof. Carl Friedrich Gauss and Wilhelm Edward Weber constructed at Gottingen a galvanometer telegraph of a single circuit of uninsulated wire a mile and a half long. The alphabet of signs was made up of right and left deflections of the needle, observed by reflections from a small mirror. Gauss was the first to employ magneto-electricity in telegraphs. Weber added to the signaling device a delicate apparatus for setting off a clock alarm.

1836.—Prof. C. A. Steinheil, of Munich, undertook, at the request of Gauss, the development of the arrangement above described, and constructed a similar galvanometer telegraph line two miles in length, introducing considerable improvements. The next year Steinheil discovered that the ground might be made a part of the circuit, thus dispensing with a second wire for the return circuit.

1837.—Mr. William Fothergill Cooke and Prof. Charles Wheatstone patented in England a galvanometer or needle telegraph very similar to the earlier one of Schilling, employing six wires and five indicating needles. An experimental line a mile and a quarter long was worked with partial success July 25; and one thirteen miles long was established in 1838.

While these experiments with the needle were going on the electro-magnet was being developed and applied.

1820.—The germ of the electro-magnet was discovered by Arago, who observed that the electric current would develop magnetic power in strips of iron and steel.

1824.—William Sturgeon, England, produced the true electro-magnet with its intermittent control of an armature.

The electro-magnet of Sturgeon was improved by Professor Henry in 1828; and in 1829 he exhibited a larger magnet of the same character, tightly wound with 35 feet of silk covered wire. A pair of small galvanic plates, which could be dipped into a tumbler of diluted acid, was soldered to the ends of the wire, and the whole mounted on a stand. This was the first magnetic spool or bobbin. This invention was further improved the same year, and in 1830 Professor Henry, assisted by Dr. Philip Ten Eyck, constructed an electro-magnet which lifted 750 pounds. In 1831 he made one weighing 82½ pounds, which sustained over a ton. In the meantime Professor Henry practically worked out the differing functions of quantity and intensity magnets, and experimentally established the conditions required for magnetizing iron at great distances through long conducting wires. This first made the electro-magnet available for telegraphic purposes.

1831.—The transmission of signals through a mile of copper bell wire interposed in a circuit between a small Cruickshank's battery and an intensity magnet—a practical telegraph—was practiced by Professor Henry.

"This memorable experimental telegraphic arrangement involved three very significant and important novelties. In the first place, it was the first electro-magnetic telegraph employing an 'intensity' magnet capable of being excited at very great distances from a suitable 'intensity' battery. . .

"In the second place, it was the first electro-magnetic telegraph employing the armature as a signaling device, or employing the *attractive* power of the intermittent magnet, as distinguished from the directive action of the galvanic circuit. That is to say, it was, strictly speaking, the first magnetic telegraph.

"In the third place, it was the first *acoustic* electro-magnetic telegraph."

Further on Mr. Taylor pertinently remarks that it is suggestive to consider how different would have been the popular estimate of Professor Henry's labors if he had been worldly-wise enough to secure an early patent on these three indisputably original and most pregnant features of telegraphy.

1837.—Professor Samuel F. B. Morse devised a magneto-electric telegraph capable of transmitting signals through a circuit of forty feet, but failed for longer distances from the circumstance that he used a quantity current. His friend, Dr. Gale, made for him an intensity battery, and added a hundred or more turns to the coil of wire around the poles of the magnet. With these necessary (and radical) improvements the apparatus was made to work through ten miles of wire. In applying for a caveat for his invention, October 6, 1837, Professor Morse specified six distinct parts, not one of which enters into the established "Morse" telegraph of to-day. Mr. Taylor shows that Professor Morse's real contribution to telegraphy consists first in the adaptation of the armature of a Henry electro-magnet to the purpose of a recording instrument; and second, in connection therewith, the improvement on the Gauss and Steinheil dual-sign alphabets, made by employing the single line dot and dash alphabet.

In his general summary of the history of the origin and development of the electro-magnetic telegraph, Mr. Taylor sets down the leading preparatory investigations and discoveries as these five:

1. The discovery of galvanic electricity by Galvani, 1786–1790.
2. The galvanic or voltaic battery by Volta, 1800.
3. The directive influence of the galvanic current on a magnetic needle by Romagnosi, 1802, and by Oersted, 1820.
4. The galvanometer by Schweigger, 1820 (the parent of the needle system).
5. The electro-magnet by Arago and Sturgeon, 1820–1825 (the parent of the magnet system).

The second half dozen capital steps in the evolution of telegraphy were:

1. Henry's most vital discovery, in 1829 and 1830, of the intensity magnet and its intimate relation to the intensity battery.
2. Gauss' improvement, in 1833 (or probably Schilling's, considerably earlier), of reducing the electric conductors to a single circuit by the ingenious application of a dual-sign, so combined as to produce a true alphabet. (The anticipations of this idea by Lomond in 1787, Cavallo in 1795, and Dyar in 1825, are not regarded as practically influential in the progress of telegraphy.)
3. Weber's discovery, in 1833, that the conducting wires of an electric telegraph could be carried through the air, without insulation, except at the points of support.
4. As a valuable adjunct to telegraphy, Daniell's invention of a constant galvanic battery in 1836.
5. Steinheil's discovery, in 1837, that a single conducting wire is sufficient for telegraphic purposes.
6. Morse's adaptation of the armature of a Henry electro-magnet as a recording instrument, 1837, and the single line dot and dash alphabet in 1838.

The earlier needle type of electro-magnetic telegraph has found its special application in ocean lines, no element of the Morse system entering into the operation of submarine cables.

The more recent telegraphic developments do not fall within the scope of Mr. Taylor's review. A few other dates, as given by Prescott, may appropriately serve to complete this chronology.

1861.—Reiss discovered that a vibrating diaphragm could be actuated by the voice so as to cause the pitch and rhythm of vocal sounds to be transmitted to a distance and reproduced by electro-magnetism.

1872.—Stearns perfected a duplex system, whereby two communications could be simultaneously transmitted over one wire.

1874.—Edison's quadruplex system was invented.

1874.—Gray invented a method of electrical transmission, by means of which the intensity of tones as well as their pitch and rhythm could be reproduced at a distance; and subsequently conceived the idea of controlling the formation of electric waves by means of the vibrations of a diaphragm capable of responding to all the tones of the human voice.

1876—Telephone invented.—Bell invented an improvement in the apparatus for the transmission and reproduction of articulate speech, in which magneto-electric currents were superposed upon a voltaic circuit, and actuated an iron diaphragm attached to a soft iron magnet. During the same year Dolbear conceived the idea of using permanent magnets in place of the electro-magnets and battery previously employed, and of using the same instrument for both sending and receiving.

1877.—Edison's carbon telephone was brought out.

To these may be added Edison's electro-motograph, of electro-chemical telephone, 1877.

1878.—Duplexing of ocean telegraph.

1879.—Cowper's writing telegraph.

1880.—Field's successful substitution of dynamo-electricity for galvanic batteries in telegraphing.

Another Comet.

Capt. A. H. Markham, R. N., of H. M. S. Triumph, the flagship on the Pacific Station, reports that a comet was observed during the voyage from Payta in Peru, to Manta on the coast of Ecuador. The Triumph left Payta on February 7. The comet was first seen on the evening of the 7th at about 8 o'clock. The nucleus was distinctly made out, bearing southwest at an altitude of 7° above the horizon. The tail, a long spreading one, was not very brilliant, but could be clearly traced to an altitude of 35°, the observed termination bearing about south-southwest. The whole phenomenon subtended an angle with the horizon of about 70°. It was situated in the constellation of Argo Navis, and the direction of the tail was in a line almost equidistant between Sirius and Canopus. It set at about 9:30 P.M.

On the next evening it was again seen at about 8 P.M., but nearer the horizon, which proved that it had been traveling with extraordinary rapidity. Although the nucleus was closer to the horizon than on the preceding evening, the altitude of the end of the tail was 40°, showing that it had increased in size. Clouds banking up to the southward prevented Capt. Markham from observing the time of setting. On the 9th, the third evening of observation, it was very hazy, but the tail could still be seen, resembling the streamer of an aurora, in the same position as on the two previous evenings. At the same time a bright luminous patch was observed immediately under Canopus.

ACID PROOF CEMENT.—Make a concentrated solution of silicate of soda, and form a paste with powdered glass. This simple mixture is said to be invaluable in the operations of the laboratory where a luting is required to resist the action of acid fumes.

MISCELLANEOUS INVENTIONS.

An improved process of securing moulded glass stones to metallic frames has been patented by Mr. Johann Fischer, of Tannwald, Bohemia, Austria. The invention consists in attaching a thin metal plate to the under side of the moulded glass stone when the same is in a soft state, and then soldering this plate on the under side of the stone to the metal frame or plate of ornaments, jewelry, etc.

Mr. Paolo Corvaja, of Palermo, Sicily, Italy, has patented improvements in the method and apparatus for ballasting ships in port. The present mode of outside ballasting consists in hanging logs of wood by chains or ropes from the sides of the vessel as counter-balancing weights, so that when the vessel attempts to keel over from any cause while lying at the wharf or being towed, the weight of the log on the higher side alone prevents her from doing so, for on the lower side the slackening of the chains or ropes lets the log on this side float in the water; hence it is of no use, and the strain of righting the vessel is thrown entirely on one side. This arrangement also fails in its purpose of keeping the vessel steady, as when she rolls the log sinking in the water relieves her of its weight, whereby an unsteady motion is maintained. The object of this invention is to temporarily ballast ships by the weight and buoyancy of the ballasting logs combined.

In an improved stove, invented by Mr. Dabney L. Ervin, of Crawfordsville, Miss., the novel feature consists in arranging the binding rods of the stove in vertical grooves made in the edges of the side and back plates, so that they may be protected from burning; also in a peculiarly constructed soot drawer and scraper combined; and in an ash pan secured in position in a novel manner.

Mr. Henry R. Robbins, of Baltimore, Md., has patented a means for enabling the driver to make change for the passengers or deliver tickets to them without requiring the passengers to pass to the end of the car; and to this end it consists in combining with a street car two or more pneumatic tubes opening through doors at different points in the length of the car, and at the front end opening near the driver, together with suitable carriers for traversing the said tubes with the money or tickets, and an air forcing apparatus and a valve for directing the current through any one of said tubes, whereby the transmission of tickets or change is easily effected as between the driver and passenger.

Mr. Benjamin F. Luce, of Janesville, Minn., has patented an improvement in the class of laterally swinging gates having hinges or hinge attachments consisting of a roller and an inclined plane resting thereon, the two co-operating in such a manner as to render the gates self-closing.

A target and target stand, to be used in archery, lighter and more durable than those now in use, and possessing the advantage over others of stopping the arrows and allowing them to be easily withdrawn and without injury, has been patented by Mr. William A. Tangeman, of Lockland, Ohio.

In the ordinary connection between the governor and its valve the sliding action and free movement of the governor valve necessary to allow it to be sensitively acted upon by the governor permits such a leakage of steam as prevents the positive and reliable effect of the governor. Mr. Cyrus B. Cook, of Cynthiana, Ky., has patented an invention consisting in combining with the ordinary screw steam throttle valve devices whereby the engine is made to act upon its throttle valve to positively open or close the same, according to the requirement of the work.

An improved cut off for steam engines has been patented by Mr. William Redmond, of Greenville, S. C. The inventor makes use of a rocking lever connected with the valves and with the eccentric rod. The connection with the eccentric rod is made by a block that is fitted for movement in the rocking lever to and from the fulcrum thereof, and is positioned by connections from a speed governor, so that as the governor balls rise a quicker movement is given to the valves and the reverse as the balls fall.

RECENT DECISIONS RELATING TO PATENTS.

Circuit Court of the United States.—District of Vermont.—Wheeler, J.

AN INJUNCTION THAT PROHIBITS THE USE OF AN ARTICLE AFTER THE PATENT HAS EXPIRED.

American Diamond Rock Boring Company vs. Charles Sheldon, Charles H. Sheldon, John A. Sheldon, Charles H. Slason. In equity. February term, 1880.

A motion for a rehearing has been filed since the decree for an injunction and an account, in support of which counsel for the defendants have submitted a brief; and a motion to restore the injunction as to machines made during the life of the patent infringing upon it has been heard.

The motion for a rehearing rests entirely upon the ground that the decision made is, as is alleged for many reasons, erroneous, and is supported by the certificate of two counsel.

The English practice of granting a rehearing upon the certificate of two counsel as a matter of course does not prevail in the federal courts of this country. *Brown vs. Aspden*, 14 How. 25; *U. S. vs. Wright's Admr.*, 1 Black, 489; *Public Schools vs. Walker*, 9 Wall. 603. According to the present practice in this court the granting such motion rests in the sound discretion of the judges who have heard the cause or made the decision. This seems to be the general practice in the circuit courts of the United States. *Daniels vs. Mitchell*, 1 Story, 198; *Jenkins vs. Eldridge*, 3 Story, 299. This is all that is claimed by counsel for the defendants.

The brief has been carefully examined and it presents scarcely anything not before presented by counsel and fully considered. The validity of the reissued patent was established by Judge Shipman upon substantially the same record in the Southern District of New York. *Am. Dia. Rock Boring Co. vs. Sullivan Machine Co.*, 14 Blatchf., 119.

That decision was followed and concurred in in this case, and the decision in that respect could not be changed in this case without overruling that as well as the one in this case. The only other questions are those relating to infringement and to the effect of the New Hampshire decree. The question of infringement by the means held to be an infringement in this case was not determined by Judge Shipman in either case before him. It was merely postponed to final hearing; so that question was fully open. It was very carefully considered, and nothing new is presented in regard to it.

It seemed to be understood or assumed that the patent has been held to cover a conical boring head; but that is not correct. It has been merely held that filling into the center to make a conical head to bore by the same means as the annular head infringes the patent for the annular head, although it may be and probably is an improvement upon the annular head. And likewise in regard to filling out the stock even with the laterally projecting diamonds.

And there is nothing new about the New Hampshire decree. The fact remains that the causes of action there were different from those here, so they had not passed under judgment. And the issue here is not shown to have been actually decided by the court there relating to the merits of either case.

It is urged that the plaintiff does not proceed to an accounting under the decree so that the defendants can appeal. This motion, however, was filed before there was any time for such accounting, and its pendency may have thus far prevented. Whether it has or not, that is no ground for a rehearing, although it might become a ground for dismissing the bill for want of prosecution.

On the whole it is quite apparent that a rehearing under the rules would not, with any reasonable degree of probability, change the result, but would only delay this and other causes, and add to the expense of the parties.

The patent was granted under the acts of Congress of 1836 and 1861, and carried the full and exclusive right and liberty of making, using, and vending to others to be used, the patented invention during the term of the patent. Act of 1836, section 5. The defendants have machines made during the term of the patent, and which were infringements when made. If they could be made then and used now in defiance of the owner of the patent the exclusive right granted would not be fully enjoyed. The grant of the exclusive right is substantially the same in this country as it is in England. The question raised here arose there in *Crossly vs. Derby Gaslight Co.*, Webst. Pat. Cas., 119. The case is more fully reported in 4 Law Jour. N. S. Chan., 25. There the patent would expire on the 9th December, 1829, and on the 28th November, before a bill was filed praying for an injunction against using infringing machines and for an account, the Vice Chancellor granted the injunction and directed the account, and the defendants appealed. After argument, the Lord Chancellor Lyndhurst, said: "This is an appeal from his Honor the Vice Chancellor, and is a case for an injunction against the invasion of a patent right, by preventing the use of certain gas meters. This case is very peculiar, and is distinguishable from all other cases in the books. It appears that the plaintiff obtained his patent on the 9th of December, 1815, and that on the 28th of November, 1829, only a few days before the patent expired, he filed a bill. It was objected that the court would not interfere just on the eve of the expiration of the patent and grant an injunction which would only last a week. The point has never yet been decided; but I am of opinion that the court would interfere after a patent has expired to restrain the sale of articles manufactured previous to its expiration in infringement of a patent right; and that a party would not be allowed to prepare for the expiration of a patent by illegally manufacturing articles and immediately after its expiration to deluge its markets with the products of his piracy, and thus reaping the reward of his improbous labor in making it. The court would, I say, in such case restrain him from selling them even after the expiration of the patent." This doctrine does not appear to have been denied or questioned afterward, and was frequently carried out in effect by decreeing the destruction of infringing machines. *Betts vs. De Vitre*, 34 Law Jour. Chan., 289; *Needham vs. Oxley*, 11 Weekly Rep., 852.

In Curtis on Pat., Sec. 436, it is laid down as clear law that "if the patent has expired, the account and the injunction will extend to all the articles piratically made during the existence of the patent, though some of them may remain unsold." The illegality attaches to the things themselves. The person making them has no right to make them, no right to them when made; he can impart none, and none can accrue by their passing into time when they might be made. The ordinary injunction in such cases in effect restrains all infringement of the patent, and is in form perpetual. It would doubtless cover an illegal sale or use after the expiration of the patent. In this case the ordinary injunction has been suspended in the course of the proceedings to limit the term of the patent, and there is, therefore, no injunction now in force.

The injunction is restored as to machines made in infringement of the patent.

THE VOLATILE OIL OF MUSTARD.

BY WM. L. DUDLEY, PROFESSOR OF ANALYTICAL CHEMISTRY AND TOXICOLOGY, MIAMI MEDICAL COLLEGE OF CINCINNATI, O.

When the flour of black mustard, after having been freed from the fixed oil by pressure, is macerated for several hours with water and then distilled it yields 0·5 to 0·7 per cent of of a very pungent volatile oil. This compound has the properties and composition of the sulphocyanate of allyl, $C_4H_5NS = \left.\begin{matrix}(C\,S)\\(C_3H_5)'\end{matrix}\right\}N$. Its most characteristic reaction is its combination with ammonia, with which it unites immediately, forming crystalline thiosinnamine or sulphocyanate of allyl-ammonium, $H_3(C_3H_5)N.CNS$.

This volatile oil does not pre-exist in the seed of black mustard, but is formed from myronic acid contained therein, under the influence of water and a peculiar ferment called myrosin, which also exists there. Consequently it is not produced unless the mustard flour is allowed to macerate with the water some time before distillation. The myrosin of black mustard being limited in quantity, the best yield of the oil is obtained by mixing the seeds of the white and black mustard. White mustard seeds contain no myronic acid, consequently it is impossible to obtain the volatile oil of mustard from that alone.

The oil is colorless or slightly yellow; its boiling point is 148° C., and specific gravity 1·009 to 1·010; it is somewhat soluble in water, but dissolves easily in alcohol and ether. It has a very pungent and acrid odor and taste. It prevents the coagulation of serum albumen as well as alcoholic fermentation.

Oil of mustard is occasionally prepared artificially by distilling sulphate or iodide of allyl with potassium sulphocyanate. The following is an analysis by Dr. E. Mylius of a sample artificially prepared: Allyl sulphocyanide, 92·2 per cent; carbon bisulphide, 0·8 per cent; hydrocyanic acid, 0·2 per cent; polysulphides (chiefly allyl-trisulphide), 4·0 per cent; and non-volatile bodies containing nitrogen and sulphur, 3·0 per cent.

This oil has been used in medicine, chiefly externally, for its powerful rubefacient properties, blistering the skin when applied to it. Schwalbe (Deut. Chem. Ges. Ber. v. 286) says the addition of mustard oil to cow's milk (1 drop to 20 grammes) prevents coagulation. The mixture may be kept in summer for weeks in half filled bottles without coagulating; but after five or seven weeks the casein was found to be converted into albumen, and the liquid was strongly acid. According to Mitscherlich it is the most deadly of all ethereal oils, 4 grammes killing a kitten in two hours, 15 grammes in a quarter of an hour. The *post-mortem* appearances were those of acute gastro-enteritis, and the smell of the oil pervaded the blood, urine and lungs.

The commercial oil is much adulterated with alcohol, carbon bisulphide, petroleum spirit, oil of gilliflowers, and castor oil. Its purity can be tested very easily in the following manner: If several drops are allowed to fall on water they should sink to the bottom on very slight agitation, and should remain perfectly clear. A slight admixture of petroleum spirit causes the drops to remain on the surface. If the oil contains 5 per cent of strong alcohol the drops will become opalescent. Five drops of the pure oil of mustard dissolve in fifty of strong sulphuric acid to a clear deep yellow liquid; if it is adulterated with other vegetable oils they will become charred, and the solution will be dark brown or black; but carbon bisulphide, if present, will separate in minute drops and render the liquid turbid.

The Wheat Crop of the World.

The wheat crop of the whole world for 1879 shows a deficiency of over 375,000,000 bushels, nearly 200,000,000 bushels of the deficiency falling to Europe. The following table, compiled from the *Bulletin des Halles et Marches*, shows the yield for each large wheat raising country compared with the average yield:

	Average yield. Bushels.	Yield for 1879. Bushels.
United States	337,500,000	337,500,000
France	230,172,000	172,125,000
Russia	180,000,000	157,500,000
Germany	99,000,000	90,000,000
Spain	94,500,000	78,750,000
Italy	87,550,000	67,500,000
Austria Hungary	76,500,000	63,000,000
Great Britain	83,500,000	47,500,000
Turkey	34,500,000	29,500,000
Roumania	27,000,000	22,500,000
Belgium	19,150,000	14,650,000
Portugal	6 750,000	5,675,000
Algeria	20,500,000	16,875,000
Canada	13,500,000	13,500,000
Australia	13,500,000	14,650,000
Egypt	13,500,000	11,500,000
Netherlands	4,615,000	3,375,000
Greece	3,500,000	3,375,000
Servia	3,375,000	2,812,500
Denmark	2,250,000	2,250,000

The Export Trade in Oysters.

The rapid increase in the exportation of oysters to Europe during recent years is shown by the following figures, as given by the Bureau of Statistics:

	Barrels.	Value.
1876	42,839	$214,195
1877	52,124	260,620
1878	78,612	393,061
1879	90,663	453,306
Totals	264,238	$1,321,183

During the winter just past the shipments have been much greater than during the corresponding weeks of 1878–79. The oysters are shipped in barrels on steamers, and generally arrive in good condition. The great bulk of them goes to England. Those sent to the Continent go almost exclusively to Amsterdam.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

Lubricene, Gear Grease, Cylinder and Machinery Oils. R. J. Chard, 6 Burling Slip, New York.

OFFICE OF THE HALDEMAN PAPER COMPANY, LOCKLAND, O., April 30, 1880.

H. W. Johns M'f'g Co., New York:

GENTLEMEN: In the year 1875 we built a warehouse, 30 x 100, which we covered with your Asbestos Roofing. We have coated it with your roof coating once since it was first applied, and to all appearances it is as good to-day as when first put on. We were so much pleased with this warehouse roof that when we built a new mill, in 1877, we covered it with your Asbestos Roofing. This mill roof has been much admired by all who have seen it and taken the trouble to examine it. It has stood the test of the extremes of weather—two summers' heat and two winters' cold—and resisted all the storms to which it has been exposed. To-day it is in prime condition, and with ordinary care we see no reason why it should not continue to be a good roof for twenty years.

Yours very truly, J. C. RICHARDSON, Pres.

For Sale.—4½ inch refr. Telescope Prism, 4 eyepieces and tripod. Price, $160. H. M. Holbrook, Jersey City, N.J.

Machinery Salesman Wanted.—One who thoroughly understands and can sell Iron and Wood Working Tools. Address T. S. & A. J. Kirkwood, Chicago, Ill.

Wanted—Situation as Foreman or Superintendent of Foundry and Machine Works. Address Box 86, Toledo, O.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Wanted, by a Steam Heating Engineer, situation as Superintendent or Outside Foreman; 20 years' experience; will accept a percentage on profits as part pay; present engagement expires June 1. Address Wm. J. Baldwin, M.E., Elmira, N. Y.

Blake's Belt Studs are the best and cheapest fastening for leather and rubber belts. Greene, Tweed & Co., 118 Chambers St., New York.

Steel Figures, $1; Letters, $3 a set. York & Smith, Cleveland, Ohio.

Wanted—A Machinist. One who has wrought at Carriage Hardware Manufacturing, and is fully able to construct the dies and tools necessary for such goods. Address, with references, George Gillies, Gananogue, Ontario, Canada.

For the best Brick Moulds made in country, address D. J. C. Arnold, New London, Ohio.

Alcott Lathes with Nulling Attachment. Wm. Scott, Binghamton, N. Y.

For the Development of New Ideas, try Anderson Bros., Peekskill, N. Y. Experience large.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Geared Power Press, cost $450, for $200. York & Smith, Cleveland, Ohio.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipe, elbows, and valves. See p. 294.

Power, Foot, & Hand Presses for Metal Workers. Moderate prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

15 H. P. Engines, complete order, $150. York & Smith, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Walrus Leather and Walrus Wheels for Polishing all kinds of Metals. Greene, Tweed & Co., 118 Chambers St., New York.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 300.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 284.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Small High Speed Steam Yachts complete or in parts. Geo. F. Shedd, Waltham, Mass.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 300.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 49 and 50 Astor House, New York.

Blake "Lion and Eagle" Imp'd Crusher. See p. 301.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 301.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 317.

Peck's Patent Drop Press. See adv., page 301.

4 to 40 H. P. Steam Engines. See adv. p. 285.

Forsaith & Co., Manchester, N. H., & 207 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

$400 Vertical Engine, 30 H. P. See page 316.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

For Standard Turbine, see last or next number.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Wanted—The address of 40,000 Sawyers and Lumbermen for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 10 cents per pound. Fully warranted.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 316.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 316.

For Separators, Farm & Vertical Engines, see adv. p. 316.

The Horton Lathe Chucks; prices reduced 25 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

For Patent Shapers and Planers, see ills. adv. p. 316.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 174.

The 1880 Pennsylvania Lawn Mower.—Light draught and easily adjusted. Machines warranted. See illus. adv. last week. Lloyd, Supplee & Walton, Philadelphia, Pa.

Send stamp for Illustrated Descriptive Price List of the Step Ladder, Ironing Table, and Clothes Drier. An ingenious combination. Useful in hotels, laundries, and every household, in every climate. See description in No 12, Vol. 42, SCIENTIFIC AMERICAN. J. H. Martin, Hartford, New York.

Patent Steam Cranes. See illus. adv., page 316.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

For Power Paper, Lard, Cider Presses, see adv. p. 316.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 317.

Combined Universal Concentric or Eccentric and Independent Jaw Chucks. Pratt & Whitney Co., H'tf'd, Ct.

For Wood-Working Machinery, see illus. adv. p. 316.

C. J. Pitt & Co., Show Case Manufacturers, 296 Canal St., New York. Orders promptly attended to. Send for illustrated catalogue with prices.

For Middlings, Mill and Mill Furnishing, see adv. p. 316.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 317.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Mackenzie Cupola and Blower. The very best apparatus for melting iron; and with water bosh for smelting lead, silver, or copper ores. Send for pamphlet. Smith & Sayre Manuf. Co., 21 Courtlandt St., New York.

Penfield (Pulley) Block Works. See illus. adv. p. 316.

NEW BOOKS AND PUBLICATIONS.

THE FOOD OF BIRDS. THE THRUSH FAMILY. By S. A. Forbes. From Trans. Ill. State Horticultural Society. Vol. XIII. 1879.

The thrush family in Illinois embraces nine species: the robin, the cat bird, the brown thrush, the wood thrush, the hermit thrush, Swainson's thrush, the Alice thrush, the mocking bird, and Wilson's thrush, of which the first three are most numerous and important. From an examination of the stomachs of 149 specimens of the family, shot in all months from March to September, Mr. Forbes has endeavored to determine the food of these birds and the probable effects of their foraging. Other species of birds will be studied in like manner during the coming seasons. The line of investigation thus marked out is a promising one; but much more information will have to be gathered before any trustworthy deductions can be drawn touching the relative economical value of the different species.

SEVENTH ANNUAL REPORT OF THE PROGRESS OF THE TOPOGRAPHICAL SURVEY OF THE ADIRONDACK REGION OF NEW YORK. By Verplanck Colvin. Albany, 1880.

In addition to a statement of the work of the survey during the year 1878, this volume gives a condensation of the reports for 1874, '75, '76, '77, and '78, with late results in geodetic and trigonometrical measurements, magnetic variation, hydrography, river surveys, leveling and barometric hypsometry, meteorology, rainfalls, botany, zoology, and geology, with many maps, engravings, and chromo-lithographs.

OFFICIAL REPORTS, ETC.

The following named reports of various governmental departments, societies, and so on, have been recently received:

Report of the Director of the Central Park Menagerie, Department of Public Parks, city of New York, for 1879.

Reports for 1879 and 1880, New York Meteorological Observatory, Central Park, New York. Daniel Draper, director

Union League Club; Report on the subject of the Water Supply of New York. 1880.

Thirty-first Annual Report of the Trustees of Astor Library, for the year ending December 31, 1879.

Report of the Special Committee of the Chamber of Commerce of the State of New York on Railroad Transportation, 1880.

Geological Survey of New Jersey. Annual report for 1879. George H. Cook, State Geologist. Trenton: W. S. Sharp.

First Report of the Superintendent and Secretary of the Burlington Waterworks, Burlington, Iowa, 1880. Ira A. Holly, Superintendent.

The Northern Water Route; Lake Superior to the Red River of the North. Resolutions adopted by the Chamber of Commerce, Duluth, Minnesota, February 22, 1880.

United States Government Reports, Washington, D. C.

Annual Report of the Operations of the United States Life Saving Service for the year ending June 30, 1879.

Army Register for January, 1880.

Report of a Board of United States Naval Engineers on the Herreshoff Boiler and System of Machinery for Steam Yachts, etc. Navy Department, December, 1879.

Annual Report of the Chief of Ordnance for the Fiscal year 1879.

PRACTICAL HINTS ON MILL BUILDING. By R. James Abernathey. Moline, Ill.: R. James Abernathey. 8vo, cl., pp. 298. Price $4.

A plain, simple, practical, and sensible treatise on flour milling and the building of flour mills, apparently designed with special reference to the needs of young millwrights who, without being either machinists or carpenters, must have a working knowledge of much that belongs to both those trades as well as a practical knowledge of the construction and use of the various apparatus used in flour mills. The author has calculated several new tables on gearing, belting, and shafting, and has added much other tabular matter likely to be useful to all classes of mechanics and manufacturers.

POCKET MINING ATLAS. Compiled by Edwin Bolitho. New York: *Engineering and Mining Journal*, 1880.

A handy pocket atlas, showing on twenty-eight maps the principal mining districts and the location of the chief mines of the United States. The new mining districts of Colorado are given with especial fullness.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) F. H. S. asks: 1. Can I make a black aniline ink for working the new copying process? If so, please give formula. A. There is no satisfactory black. 2. What grade of aniline is used for the darkest violet inks? A. 4 B to 6 B methyl violet.

(2) W. S. R. asks for information in regard to making cast iron bells by mixing the material with the iron in the ladle, so it will not interfere with the balance of the iron in the cupola; and also, do you know of a cheap liquid bronze for bronzing bells or cast iron? A. To increase the hardness and sonorous qualities of the metal it is essential that the additions (of manganese or titanium) should be made in such a way that their thorough fusion and diffusion throughout the mass of metal should be effected; otherwise a non-homogeneous or brittle casting is apt to result. The mixing cannot be done in a ladle. For a bronze a mixture of coarse gold bronze in thin copal or amber varnish may be employed.

(3) G. F. C. asks: What kind of liquid or sizing is best to mix with ordinary bronze for painting iron wire, etc.? A. Common stopping or filling varnish will answer in some cases; gold size is best.

(4) T. M. H. asks how to oxidize iron wire to look like black japanning. A. We know of no way of "oxidizing" the metal to present such an appearance.

(5) J. B. C.—The lines on the "jellograph" may be removed by remelting the composition. We know of no better or simpler way.

(6) J. M. writes: In your last number you give a method of making waterproof cloth by dissolving rubber in bisulphide of carbon and adding a certain percentage of alcohol. Now, I cannot find any of our druggists that can make that preparation. They say if you had given a certain amount of rubber to bisulphide of carbon, then they could tell what percentage or how much six per cent of alcohol is. A. Bisulphide of carbon, 94 oz.; absolute alcohol, 6 oz.; mix a sufficient quantity of this to accomplish the softening of the rubber.

(7) A. B. T. writes: I live in a locality where much of the water is strongly impregnated with lime. After using for two or three months the hot water pipes leading from the range to the boiler in my kitchen become entirely closed by the sediment deposited in them during the boiling of the water, and this obstruction afterwards hardening can only be removed by a cold chisel. What can be done to soften the water without injuring its quality for ordinary purposes, or to prevent its clogging the pipes and incrusting the boiler? A. Try the addition of a small quantity of dry slaked lime, beginning with about 10 grains of lime to the gallon. The "lime" in this water is doubtless lime carbonate, held in solution by free carbonic acid. The addition of a suitable quantity of lime under the circumstances withdraws the free, carbonic acid, forming with it insoluble carbonate of lime; and at the same time throwing down what lime carbonate the acid water held. The only other practical remedy is to heat the water, when the acid gas escapes, leaving the lime carbonate insoluble. Water very often contains more or less sulphate of lime, which cannot be economically eliminated.

(8) J. Y. asks. 1. How is sheet metal prepared for tinning? A. The plates, bent V-shape, are placed on edge in a pickle of dilute muriatic (water 6, acid 8) acid for about five minutes, then placed in a row (1) on the floor, and by means of a rod passed through them lifted into an annealing oven, where they are heated to redness and the scale drops off. They are then allowed to cool, straightened on an anvil, and cold rolled between highly polished rolls under great pressure. The plates are then immersed in fermenting bran water, at 100° Fah., for 12 hours, the plates standing on one edge being reversed after six hours. From the bran water the plates are transferred to a pickle of dilute sulphuric acid at 100° Fah. for an hour, which makes them bright; then washed and scoured with hemp and sand, and after washing in clean water are ready for the grease pot, in which they are kept for an hour or more before putting in the tin bath. 2. What material are the vessels made of for holding the acids in the tinning process? A. Usually of wood.

(9) C. asks: 1. What is 1 horse power? A. 33,000 lb. raised one foot high per minute. 2. Man's power? A. The usual allowance is five to six men equal one horse. 3. In what book on mechanics can the principle of the pulley and the duplication of force by it be studied best? A. "Jamieson's Mechanics," "Cambridge Mechanics."

(10) L. G. S. asks: How many horse power make a "run of stone," that is, in a run of stone (so-called) what amount of force is given when computed in horse power? In this community, where water power is used exclusively, I have asked several, and find no two to agree in the estimate. Will you give it? A. The power required to drive a "run" of stones depends upon their weight and diameter and the velocity at which they are driven. Formerly from 5 to 8 horse power was allowed, but on acount of increased weight and velocity we suppose that now from 7 to 12 horse power should be allowed.

(11) W. C. B. asks: 1. Can you inform me how to construct a compressed air tank to run a one horse power engine? A. The best form is a plain cylinder, like a cylinder boiler; its capacity will depend upon the length of time you wish to run the engine with one charge of air. 2. Can I buy such a thing, and if so, where? A. Such reservoirs may be obtained from almost any boiler maker.

(12) H. L. C. asks What should be the number of revolutions per minute of a 3 inch circular saw, and also of a planer head, 1¼ inches diameter, to do good work on hard or soft wood? Will the planer work with 2,200 per minute? A. We should say 7,500 to 8,000 revolutions per minute. The head is very small, and may be run 4,000 to 4,400 revolutions per minute.

(13) S. H. B. asks 1. Is the steel of any special grade required for permanent magnets, or must it be forged in any particular way to get compactness of grain? A. A medium quality of steel is better than the finest. It should be worked as little as possible, and should be hardened throughout and drawn down to a straw color. 2. Are they magnetized by a coil of wire or with a strong electro-magnet? I have an electro-magnet which will readily lift more than one hundred pounds, cores 1 inch diameter, four layers of wire about No 14, six cells Grove battery, platinums 6 by 2 inches, but I do not get very strong magnets by this means yet. A. For charging bar magnets a coil which will just fit the bar seems to answer little better than an electro-magnet. You should make the coil of No. 14 wire; 6 or 8 layers should be wound one over the other. The coil should be about 3 inches long. Connect this coil with your battery, hold it vertically, and insert one of the steel bars; allow it to became suspended centrally in the coil, then push it down so that the upper end of the bar is within the coil. Allow the bar to come back to its central position, and then, before removing it from the coil, disconnect the latter from the battery. This method of magnetizing steel is described and illustrated in SUPPLEMENT 142. Telephones.—Horseshoe magnets may be charged by drawing them across the face of your large magnet always in the same direction, and disconnecting the battery as the stroke is completed. Bar magnets may be charged in the same way by clamping two of them together by the ends so as to form temporarily a horse shoe. 3. How would quite thin steel, say one-sixteenth, do, if pieces enough were used to make a magnet, say, 1 inch square section and of horse shoe shape, 8 inches long? A. Very well, but they would make a better magnet if bent one over the other. 4. Is not the Jamin magnet of even thinner steel than that? Those I mentioned are of one-quarter inch thick steel and nearly one inch broad A. Yes. 5. Would it be as well to pack up a compound magnet of straight squared pieces, and magnetize them separately, as to make the separate horseshoe shapes? A. No, the horse-shoe shape would be the best.

(14) A. C. asks: 1. What is the variation of pressure in the steam chest of a locomotive engine when she is running at regular speed with throttle open full and lever set to cut-off at half stroke, steam pressure on boiler 100 lb.? A. The variation in pressure will be from full boiler pressure, when steam is cut off, to a minimum pressure, depending upon proportions, pressure, and speed of piston. 2. How much will water compress under a pressure of 100 lb. to square inch? How much will oil compress under the same pressure? A. Compression scarcely appreciable with either water or oil. 3. How much will air compress under 100 lb. pressure? A. 100 lb. pressure above the atmosphere is =7·7 atmospheres—hence bulk=1-7·7 or a little more than ⅛.

(15) W. T. S. asks: 1. About how many horse power do we get with our engine, 7x10 inches, running at about 400 revolutions per minute, with 1¼ inch feed pipe, pressure 80 lb. per square inch? A. With 80 lb. pressure on the piston and 400 revolutions per minute, 46 horse power. 2. If the throttle valve of an engine be set to run it at 100 revolutions per minute, with 20 lb. of steam, would it not require about 80 lb. of steam to run it 200 revolutions per minute, the valve being the same as for 20 lb.? A. If 20 lb. is sufficient to overcome the resistance at 100 revolutions, it will be approximately the same (leaving out friction) at 200 revolutions, but you must supply double the quantity of steam at that pressure.

(16) E. A. G. writes: It is said that even "Homer sometimes nods," but the SCIENTIFIC does not often so much as wink. But please tell me, is it not as wise to bore a hole in the bottom of a boat to let the water out as to put a stop cock at the highest part of a siphon "to let the air out?" See SCIENTIFIC AMERICAN, April 10, page 235, answer to C. W. W., No. 35. Some one may be misled by it. A. Your criticism applied to an ordinary siphon is very pertinent, but we do not think it applies to the conditions in this case. The stop cock should be applied in connection with some means of taking out the air accumulating from leaks. Of course it was an error to say briefly stop cock. A pump or some other device for removing the air must be applied outside the stop cock.

(17) "Walter" asks: Which travels the greater distance, any given point on the face or tread of a locomotive driving wheel, or any fixed part of the locomotive, the boiler for instance? The wheel is not supposed to slip on the rail during the journey. A. The lower point of the wheel in contact with the rail has no forward motion relative to the rail; the upper point has twice the forward motion of the boiler.

(18) "Constant Reader" asks: Does a fly wheel increase the power of the engine to which it is applied? A. No.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

T. C. W.—It consists chiefly of a semi-decomposed syenitic rock with a little hematite. It cannot be called an iron ore; such an ore may occur in the vicinity.—M. D. M.—It is a fair quality of kaolin, used for making porcelain, "white wares," and pottery.—G. C. R.—It is limonite, an excellent ore of iron.—J. H. B.—The button is composed chiefly of lead, carrying a trace of silver. It probably occurs as galena—sulphide of lead.

COMMUNICATIONS RECEIVED.

On a Remarkable Group of Sun Spots. By W. R. B.
On a Freak of Lightning. By F. M. G.
On Tide Water Pipe Line. By G. L. B.
On the Cause of Thunder. By G. H. E.
On Examples of Pseudo-Crystallization. By A. L.
On Gravitation. By W. L. T.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

pril 20, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1806, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1806; but at increased cost, as the specifications not being printed, must be copied by hand.

Addressing machine, E. F. Pernot 226,781
Anode, J. Kleinhans 226,616
Ash hod, N. H. Andrews 226,589
Axle box, car, E. H. Shoemaker 226,797
Bag holder, W. B. Allen 226,586
Baking powder can, J. S. Taylor 226,804
Ballot box, J. H. Drake 226,726
Ballot box, J. Welch 226,689
Banjo, J. H. McQuilkin 226,621
Beans, peas, etc., for food, preparing, W. Butts 226,712
Bee hive, R. Himes 226,613
Belt, galvanic, T. W. Graydon 226,638
Bit brace, C. H. Amidon 226,646
Blast furnace, P. L. Weimer 226,690
Boiler tubes, fastening, C. Graham 226,741
Boot and shoe counter or heel stiffener, V. B. Morton 226,771
Boot and shoe heel, T. Cook 226,651
Breakwater, L. Kirkup 226,663
Bridge gate, draw, A. R. Sherman 226,796
Buckle, J. Rothenbucher 226,689
Button, C. H. Wood 226,815
Button and button fastener, B. L. D'Aubigne 226,732
Button, cuff, H. A. Fisher 226,736
Button, sleeve, L. Morse 226,769
Buttons, etc., machine for the manufacture of, J. F. Bapterosses 226,686
Cabinetmaker's clamp, J. L. Konig 226,617
Calculator for postage stamps, G. W. Terry 226,807
Car coupling, O. H. Drinkwater 226,727
Car coupling, J. D. Gray 226,742
Car door fastening, grain, O. H. Drinkwater 226,728
Car mover, lever power, Van Auker & Gum 226,698
Car spring, E. Cliff 226,807
Carburetor, gas, H. J. Ferguson 226,830
Carpet stretcher and tack driver, G. Turrill 226,654
Carriage, child's, C. Mattern 226,767
Cart, dumping, Z. Butt 226,649
Cart, self-loading, A. Vreeland 226,658
Check rower, Berry & Putman 226,700
Churn power, G. A. Brengle 226,704
Cider press, H. S. Tompkins 226,667
Clasp or link, P. W. Doherty 226,725
Clinometer, F. C. Davidson 226,723
Collar frames, die for forging metallic horse, Fisher & Watson 226,737
Compass adjusting binnacle, J. E. Hand 226,659
Convertible chair, C. A. Eastman 226,729
Corn sheller, J. W. Ricker 226,637
Corset, J. C. Tallman 226,805, 226,806
Cotton scraper and chopper, comb'd, L. D. Bowman 226,706
Cradle, grain, E. H. Scott 226,630
Cultivator, B. J. West 226,691
Cultivator and harrow, combined, J. W. Fleming 226,626
Cultivator, rotary, M. Johnson (r) 9,168, 9,169
Damper, stove pipe, Selden & Griswold 226,680
Dishes, butter holder for butter, W. R. Mackay 226,666
Door check, H. B. Pruden 226,795
Door lock handle, sliding, W. E. Sparks 226,682
Drawings and photographs, method of and apparatus for tinting, W. Kurtz 226,760
Dredging machine, vacuum, Hodge & Cushman 226,661
Dust receiver, carpet and floor, N. Pyles 226,788
Duster, feather, A. B. Davis 226,691
Elevator, C. R. & N. P. Otis 226,673
Fare register and recorder, N. A. Ransom 226,626
Feed rack, portable grain and hay, J. A. Kennedy 226,757
Feed water heater and filter, J. W. White 226,814
Fence post, S. Reed 226,790
Fiber, process and apparatus for manufacturing, Stephens & Darkin 226,801
Fifth wheel, H. Timkin 226,666
Firearm, breech-loading, C. Guyer 226,744
Firearm, breech-loading, A. Schneider 226,679
Firearm, breech-loading, C. E. Sneider (r) 9,166
Firearm, magazine, F. W. Tiesing 226,809
Fire escape ladder, M. Sichel 226,798
Fluid meter, C. A. Chandler 226,716
Fluting iron, W. S. Owen 226,776
Fluting iron, F. H. Stumpf 226,803
Folding chair, J. L. Styron 226,685
Fruit jar, E. M. Erdman 226,606
Fruit jar top, J. A. Paul 226,779
Furnaces, device for feeding air to, H. T. Drain et al 226,608
Game board, J. K. Ingalls 226,615
Gas, manufacture of nitrogen, T. B. Stillman 226,632
Gate, G. H. Aylworth 226,695
Glass and enamel to metal, uniting, L. Morse 226,770
Glass house furnace, J. J. Gill 226,609
Grain binder, H. E. Pridmore 226,785
Grain, etc., drier and cooler for, Mey & Stark 226,669
Grate frame, J. Walsh 226,640
Grinding mill, W. B. Pardee 226,777
Handle for trunks, bags, etc., M. Schwerin 226,794
Harness back band loop, R. M. Selleck 226,631
Harness clamp, E. Peters 226,722
Harness loops, machine for pressing and ornamenting, Lane & Avery 226,761
Harrow, Pendley & Moss 226,675
Harvester, grain, F. W. Randall 226,677
Harvester reel, W. H. Akens 226,585
Hatch, skylight, S. J. Pardessus 226,635
Hay knife, D. E. Haskell 226,746
Hay tedder, J. M. Burdick 226,711
Heating apparatus, steam, J. L. Harley 226,745
Heel plate, J. A. Cole 226,730
Heel stiffener and counter support, A. S. Robinson 226,792
Hinge, lock, W. S. Stockman 226,684
Holdback, vehicle, A. B. Douglas 226,652
Hook and eye fastener, B. Schleifer 226,793
Horse foot cooler and moistener, C. A. Root 226,628
Horse power, J. Piggott 226,784
Horse power attachment, R. D. Norton 226,671
Horse tee weight and quarter boot attachment, H. D. McKinney (r) 9,163
Horses, vehicle device for hitching, O. Dunkel 226,653
Hub, vehicle wheel, A. A. Philbrick 226,783
Hydraulic engine, J. R. Cole 226,598
Infusions, apparatus for making, D. P. Heap 226,611
Jetty shutter, J. U. Mueller 226,772
Jewelry and fancy articles, plastic composition of matter for making, I. B. Abrahams 226,583
Key ring, J. S. Birch 226,702
Knit fabric, R. F. M. Chase 226,595, 226,596
Lamp, hanging, O. F. Eichberg 226,732
Lamp, hanging or suspension, E. L. Bryant 226,708
Locomotive ash pan, C. O. Smith 226,799, 226,800
Locomotive boiler, E. H. Angamar 226,694
Loom for weaving tubular fabrics, H. W. Cady 226,594
Loom stop motion, F. O. Tucker 226,810
Low water alarm for steam boilers, W. R. Jenkins, Jr. 226,754
Lubricator, J. E. Lonergan (r) 9,164
Marker, field, W. Barron 226,697
Mechanical movement, R. C. Barrio, Jr. 226,593
Mechanical movement, J. Hill 226,751
Metal stamping, punching, and shearing machine, M. Hersberg 226,613
Microscope slides, turn table for, W. H. Bulloch 226,649
Middlings separating machine, A. & A. N. Wolf (r) 9,170
Millstone dresser, D. S. Greenwald 226,610
Moulding machine, C. Ezard 226,655
Mowing machine, J. F. Stewart 226,683
Musical instrument, mechanical, J. A. Carter 226,714
Oil, apparatus for testing lubricating, C. N. Waite 226,639
Oiler, car axle, W. H. & P. C. Burden 226,710
Ore desulphurizing apparatus, R. P. Wilson 226,692
Packing for piston rods, metallic, J. A. Osgood 226,634
Packing, metallic steam, W. P. & C. H. Woodruff 226,644
Padlock, permutation, Cook & Green 226,599
Pamphlet box, T. L. Clacher 226,717
Paper and process of making the same, H. Hayward 226,660
Paper pails, machine for making, E. Hubbard 226,752
Pen, D. MacKinnon 226,618
Pen holder, fountain, J. Monaghan 226,768
Pencil and crayon holder, B. A. Fiske 226,607
Pianoforte music desk, H. Praeger 226,676
Picture frame, W. L. Eckman 226,624
Picture frame attachment, J. W. Larcher 226,762
Pile, L. Kirkup 226,664
Pipe cleaner, J. H. Gable 226,740
Pipe stem, C. J. B. Hirsch 226,750
Plant duster, J. F. Eddy 226,730, 226,731
Planter, cotton and corn, G. E. Faucher 226,734
Planter, hand corn, T. Bickerton 226,701
Plate and dish, A. A. Love 226,665
Pliers, R. B. Jones 226,756
Plow, M. Glascock 226,609
Plow, Wanabrough & Speer 226,641
Plow and cultivator wheel, Pendley & Moss 226,674
Plow attachment, A. F. Fromm 226,637
Plow attachment, E. R. McCall 226,667
Plow, sulky, L. Brown 226,705
Plow, sulky, F. M. Foster 226,739
Plumber block, B. Hewitt 226,747
Pocket safety, J. Rosenstock 226,678
Poison distributer, Amor & Lane 226,588
Post office delivery window, G. J. Krebs 226,759
Pressure gauge for beer stills, D. Horan 226,614
Printed and varnished sheets, machine for drying, L. A. Fernow 226,735
Printing presses, collating attachment for, C. Ellery 226,604
Pulp strainer, L. Zeyen 226,819
Pump, rotary, E. B. Newcomb 226,775
Pump, windmill, J. & R. Bean 226,699
Railway rail, A. C. Vaughan 226,811
Railway switch and signal apparatus, pneumatic, H. Turner 226,657
Ruching machine, C. Clark 226,719
Sad iron, F. R. Sutton 226,633
Sand band, G. E. Purple 226,787
Saw, drag, J. Augspurger 226,590
Saw, drag, J. A. Cluxton 226,718
Saw, endless chain, E. Nunan 226,774
Sawing machine, J. B. Rickard 226,791
Scarf, neck, W. A. Laverty 226,763, 226,764
Scraper, wheeled, L. A. Sweatt 226,686
Seed crusher, cotton, W. L. Owen 226,775
Seed drills, drill point for, J. A. Jones (r) 9,165
Seed, machine for cleaning blue grass, J. D. Batson 226,698
Semolino, etc., apparatus for purifying and assorting, Thompson & Williamson 226,808
Sewer catch basin, P. Markey 226,620
Sewing machines, stand for power driven, L. Sternberger 226,803
Shawl strap handle and boot jack, M. W. Marsden 226,766
Sheep rack, S. A. Coe 226,650
Shoemaker's edge plane, A. P. Hazard (r) 9,167
Show case, G. C. Albaugh 226,645
Sign, L. Dobbelaar 226,724
Slate dressing machine, F. Shenton 226,795
Soldering iron, C. M. Dravo 226,602
Soldering iron heater, J. S. Hull 226,753
Spinning spindles, bearing for, J. S. Haworth 226,739
Spring motor, J. Warren 226,813
Square, dressmaker's, J. A. Emery 226,605
Stamp, branding, H. H. Bryant 226,707
Stanchion fastener, S. Bryant 226,706
Steam engine, R. C. Barrie, Jr. 226,591
Steam engine, Cope & Maxwell 226,600
Stocking supporter, C. C. Shelby 226,681
Stove lid bowls, etc., moulding, J. O'Keefe 226,672
Straw board, machine for lining, G. S. Eyster 226,733
Suspender clamp, M. Altmann 226,696
Tack strip, Wood yard & Brock 226,817, 226,818
Tally, grain, W. Thornton 226,635
Tap wrench, T. R. Way 226,643
Tea kettle, N. A. Mennar 226,668
Teeth, composition for filling, T. Fletcher 226,738
Telephone signal, visible, C. Ader 226,584
Thill coupling, F. P. Johnson 226,755
Ticket holder, H. Conried 226,721
Tile machine, J. C. McKenzie (r) 9,162
Tobacco leaves, machine for hooking, J. H. Pawling 226,778
Tracing wheel, D. W. Moody 226,622
Type distributing machine, J. North 226,623
Valve, steam engine slide, O. J. Byrad 226,703
Valve, steam engine slide, R. H. Carter 226,715
Vapor burner, J. S. Wood 226,816
Vault or tomb, burial, W. F. Groves 226,743
Vehicle running gear, P. Herdick 226,748
Vehicle spring, W. B. Bennett 226,593
Vehicle wheel sand guard, C. W. Ammerman 226,587
Vise and drill, combined, C. Brunner 226,709
Wagon seat, G. W. Manlove, Jr. 226,765
Washing machine, J. Paterson 226,780
Watering stock, valve for water pipes for, W. A. Warren 226,812
Waxed ends, mechanism for the manufacture of, R. Macintosh 226,619
Whiffletree, E. Warren 226,642
Whitewash composition, A. H. Kerr 226,758
Wringing machine, F. Bernhardt 226,647
Yoke center, neck, J. S. Nelson 226,670
Yoke ring, neck, H. Jacobs 226,662

DESIGNS.

Cruets, pepper, S. McKee 11,744
Knit drawers, S. Conde 11,741
Knit shirts, S. Conde 11,740
Knitted fabrics, S. Appleton 11,738
Organ case, A. Wagner 11,742, 11,743
Scarf, neck, C. H. Crossette 11,739
Spoon and fork handles, W. Rogers 11,745

TRADE MARKS.

Medicinal preparation, C. M. Coolidge 7,878
Soda fountains, A. D. Puffer & Sons 7,881
Tickings, J. Farnum & Co. 7,879, 7,880

English Patents Issued to Americans.

From April 16 to April 23, 1880, inclusive.

Baking powder can, J. S. Taylor, San Francisco, Cal.
Coating iron, process for, J. B. Jones *et al.*, B'klyn, N. Y.
Cloth stretching and calendering machine, C. A. Luther, Pawtucket, R. I.
Envelope machine, D. M. Lester, New London, Conn.
Electric light, H. S. Maxim, Brooklyn, N. Y.
Gas lighting apparatus, D. Isenminger *et al.*, Bloomington, Ill.
Heating fluids, apparatus for, C. S. Comins, Boston, Mass.
Hoisting and moving earth, apparatus for, H. A. Carson, Mass.
Holding letters, apparatus for, I. W. Heysinger, Philadelphia Pa
Life saving raft, M. Beasly, Philadelphia, Pa.
Meter, fluid, J. D. Gould *et al.*, Boston, Mass.
Motive power engine, A. H. Hearington, Rochester, N. Y.
Motor, chronometric, H. J. Wenzel *et al.*, San Fran., Cal.
Pencil sharpener, M. C. Stone, Baltimore, Md.
Photography, G. C. Bell, Brooklyn, N. Y.
Railroad switch, J. B. Carey, Boston, Mass.
Railroad rail, A. C. Vaughn *et al.*, Harrisburg, Pa.
Sewing machine motor, C. L. French, Brooklyn, N. Y.
Stoves and fireplaces, A. T. Bennett, Kenosha, Wis.
Stove, coal oil, J. H. Irwin, Philadelphia, Pa.
Steam pump, C. P. Deane, Springfield, Mass.
Telephone, E. Marx *et al.*, New York city.
Tool handles, A. D. Tyler, Brockton, Mass.
Utilizing solar heat, apparatus for, E. J. Molera *et al.*, San Francisco, Cal.
Water closets, W. Smith, San Francisco, Cal.

PROSPECTUS
OF THE
Scientific American
FOR 1880.

The Most Popular Scientific Paper in the World.

VOLUME XLII. NEW SERIES.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.